



# Northeastern University



*Adam Glanzman for Northeastern University*

## Course Descriptions 2025-2026

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Professor, Physics and Electrical and Computer Engineering; Huazhong University of Science and Technology (China), PhD

**Shu-Shih Wu**

Assistant Teaching Professor, Mathematics; Northeastern University, PhD

**Kinde Wubneh**

Assistant Professor, Entrepreneurship and Innovation and Pharmacy and Health Systems Sciences; University of Texas, Austin, PhD

**Sara Wylie**

Associate Professor, Sociology and Anthropology and Health Sciences; Massachusetts Institute of Technology, PhD

**X**

**Summer Xiao**

Assistant Professor, Accounting; University of Arizona, PhD

**Lei Xie**

Professor, Pharmaceutical Sciences; Rutgers University, PhD

**Wei Xie**

Associate Professor, Mechanical and Industrial Engineering; Northwestern University, PhD

**Xiaolin Xu**

Associate Professor, Electrical and Computer Engineering; University of Massachusetts, Amherst, PhD

**Y**

**Dena Yadin**

Assistant Teaching Professor, Marketing; Bar-Ilan University (Israel), PhD

**Milen Yakimov**

Professor, Mathematics; University of California, Berkeley, PhD

**Qimin Yan**

Associate Professor, Physics; University of California, Santa Barbara, PhD

**Shiawee Yang**

Associate Professor, Finance; Pennsylvania State University, PhD

**Sunny Yang**

Assistant Professor, Political Science and Communication Studies; The Ohio State University, PhD

**Xiaoyi Yang**

Assistant Teaching Professor, Computer Sciences; Carnegie Mellon University, PhD

**Hideaki Yano**

Assistant Professor, Pharmaceutical Sciences; Columbia University, PhD

**Lizzie Yarina**

Assistant Professor, Architecture; Massachusetts Institute of Technology, PhD

**Mathew Yarossi**

Assistant Professor, Physical Therapy, Movement, and Rehabilitation Sciences and Electrical and Computer Engineering; Rutgers University, PhD

**Abbas Yaseen**

Assistant Professor, Bioengineering; Prince of Songkla University (Thailand), PhD; Kakatiya University (India), PharmD

**Yasin Yazicioglu**

Assistant Professor, Mechanical and Industrial Engineering; Georgia Institute of Technology, PhD

**Gilbert Ye**

Assistant Professor, Civil and Environmental Engineering; University of Florida, PhD

**Lichuan Ye**

Professor, School of Nursing; University of Pennsylvania, PhD

**Adetoun Yeaman**

Assistant Teaching Professor, College of Engineering; Virginia Polytechnic Institute and State University, PhD

**Edmund Yeh**

Professor, Electrical and Computer Engineering; Massachusetts Institute of Technology, PhD

**Roi Yehoshua**

Associate Teaching Professor, Electrical and Computer Engineering; Bar-Ilan University (Israel), PhD

**Boris Yelin**

Associate Teaching Professor, World Languages and Cultures; Purdue University, PhD

**Benjamin Yelle**

Teaching Professor, Philosophy and Religion; University of Miami, PhD

**Sheng-Che Yen**

Clinical Professor, Physical Therapy, Movement, and Rehabilitation Sciences; New York University, PhD

**Ayce Yesilalay**

Associate Teaching Professor, Biology; University of Massachusetts Medical School, PhD

**Caglar Yildirim**

Associate Teaching Professor, Computer Sciences; Iowa State University, PhD

**Weitong Yin**

Assistant Co-op Coordinator, College of Social Sciences and Humanities; Northeastern University, MS

**Sze Zheng Yong**

Associate Professor, Mechanical and Industrial Engineering; Massachusetts Institute of Technology, PhD

**Moka Yoo-Jeong**

Assistant Professor, School of Nursing; Emory University, PhD

**Ilmi Yoon**

Teaching Professor, Computer Sciences; University of Southern California, PhD

**Yoseob Yoon**

Assistant Professor, Mechanical and Industrial Engineering; Massachusetts Institute of Technology, PhD

**Mark Yorra**

Senior Co-op Coordinator, Bouvé College of Health Sciences; Northeastern University, EdD

**Yizhi You**

Assistant Professor, Physics; University of Illinois, Urbana-Champaign, PhD

**Gary Young**

Professor, International Business and Strategy and Health Sciences; State University of New York at Buffalo, PhD

**Jared Young**

Professor & Gibbons-Young Professorship for the Advancement of Science, MCNU STEM & Health Unit; University of California, San Diego, PhD

**Lydia Young**

Teaching Professor, College of Professional Studies; Boston College, PhD

**Stephanie Young**

Associate Teaching Professor & W.M. Keck Foundation Professor of Creative Writing, MCNU Arts & Writing Unit; Mills College, MFA

**Sarah Young-Hong**

Associate Clinical Professor, Communication Sciences and Disorders; University of Pittsburgh, MA

**Constance Yowell**

Professor of the Practice, College of Professional Studies; Stanford University, PhD

**Deahan Yu**

Assistant Teaching Professor, Computer Sciences; University of Michigan, PhD

**Jones Yu**

Teaching Professor, College of Engineering; Massachusetts Institute of Technology, PhD

**Shuishan Yu**

Associate Professor, Architecture; University of Washington, PhD

**Yuan Yuan**

Assistant Professor, Electrical and Computer Engineering; University of Virginia, PhD

**Xubo Yue**

Assistant Professor, Mechanical and Industrial Engineering; University of Michigan, Ann Arbor, PhD

**Lua Kamál Yuille**

Professor, Law and Management and Organizational Development; Columbia University, JD

**Z**

**Nizar Zaarour**

Teaching Professor, Supply Chain and Information Management; Northeastern University, PhD

**Adel Zadeh**

Teaching Professor, College of Professional Studies; University of Cambridge (United Kingdom), PhD

**Naeem Zafar**

Professor of the Practice, Entrepreneurship and Innovation; University of Minnesota, Twin Cities, MSEE

**Jonathan Zaff**

Professor, Applied Psychology; University of Georgia, PhD

**Michelle Zaff**

Associate Co-op Coordinator, D'Amore-McKim School of Business; Suffolk University, JD

**Christos Zahopoulos**

Associate Professor, College of Professional Studies; Northeastern University, PhD

**Carl Zangerl**

Associate Teaching Professor, College of Professional Studies; University of Illinois, Urbana-Champaign, PhD

**Victor Zappi**

Assistant Professor, Music; Istituto Italiano di Tecnologia, Università degli studi di Genova (Italy), PhD

**Alan Zaremba**

Associate Professor, Communication Studies; State University of New York at Buffalo, PhD

**Fox Zarow**

Assistant Teaching Professor, Art + Design; Northeastern University, MFA

**Dan Zedek**

Professor of the Practice, Journalism; Columbia University, BA

**Ibrahim Zeid**

Professor, Mechanical and Industrial Engineering; University of Akron, PhD

**Moira Zellner**

Professor, School of Public Policy and Urban Affairs; University of Michigan, Ann Arbor, PhD

**Hongyang Zhang**

Assistant Professor, Computer Sciences; Stanford University, PhD

**Ke Zhang**

Professor, Chemistry and Chemical Biology; Washington University in St. Louis, PhD

**Ning Zhang**

Associate Professor, Pharmacy and Health Systems Sciences; Cornell University, PhD

**Shuo Zhang**

Assistant Professor, Economics and Computer Sciences; University of California, Santa Barbara, PhD

**Victoria Zhang**

Assistant Professor, Management and Organizational Development and Health Sciences; Yale University, PhD

**Xuan 'Silvia' Zhang**

Associate Professor, Electrical and Computer Engineering; Cornell University, PhD

**Xufeng Zhang**

Assistant Professor, Electrical and Computer Engineering; Yale University, PhD

**Yang Zhang**

Professor, Civil and Environmental Engineering; University of Iowa, PhD

**Yue Zhang**

Associate Professor, Accounting; University of Pittsburgh, PhD

**Zhiyuan Zhang**

Assistant Professor, Mathematics; Brown University, PhD

**Qianqian Zhang-Wu**

Assistant Professor, English; Boston College, PhD

**Pu Zhao**

Assistant Research Professor, Electrical and Computer Engineering; Northeastern University, PhD

**Qing Zhao**

Assistant Professor, Chemical Engineering; Massachusetts Institute of Technology, PhD

**Yizhen Zhao**

Associate Teaching Professor, College of Engineering; Johns Hopkins University, PhD

**Ziming Zhao**

Associate Professor, Computer Sciences; Arizona State University, PhD

**Kuncheng Zheng**

Associate Professor, Finance; University of Michigan, Ann Arbor, PhD

**Yi Zheng**

Associate Professor, Mechanical and Industrial Engineering; Columbia University, PhD

**Zheng Zheng**

Assistant Teaching Professor, College of Engineering; McMaster University (Canada), PhD

**Karen Zhou**

Assistant Teaching Professor, College of Professional Studies; University of Maryland, Baltimore, JD

**Lin Zhou**

Associate Teaching Professor, College of Professional Studies; University of Hawai'i at Mānoa, PhD

**Nan Zhou**

Visiting Lecturer, Economics; Johns Hopkins University, PhD

**Sunny Zhou**

Professor, Chemistry and Chemical Biology; Scripps Research Institute, PhD

**Xiaomu Zhou**

Teaching Professor, College of Professional Studies; University of Michigan, Ann Arbor, PhD

**Hongli Zhu**

Associate Professor, Mechanical and Industrial Engineering; South China University of Technology (China), PhD

**Jia Zhu**

Assistant Teaching Professor, Computer Sciences; Florida International University, PhD

**Juner Zhu**

Assistant Professor, Mechanical and Industrial Engineering; Massachusetts Institute of Technology, PhD

**Xuwen Zhu**

Assistant Professor, Mathematics; Massachusetts Institute of Technology, PhD

**Sali Ziane**

Teaching Professor, World Languages and Cultures; University of Paris XIII (France), PhD

**Emily Zimmerman**

Professor, Communication Sciences and Disorders; University of Kansas, PhD

**Gregory Zimmerman**

Professor, School of Criminology and Criminal Justice; State University of New York at Albany, PhD

**Katia Zolotovsky**

Assistant Professor, Art + Design and Chemistry and Chemical Biology; Massachusetts Institute of Technology, PhD

**Rose Zoltek-Jick**

Associate Teaching Professor, Law; York University (Canada), LLB

**Ronald Zullo**

Senior Lecturer, Accounting; Bentley University, MS

**Günther K. H. Zupanc**

Professor, Biology; University of California, San Diego, PhD; University of Tübingen (Germany), Dr. rer. nat. habil.

**Alexander Zvonok**

Assistant Research Professor, Center For Drug Discovery; Belarusian State University (Belarus), PhD

**Nikolai Zvonok**

Assistant Research Professor, Center for Drug Discovery; Shemyakin Institute of Bioorganic Chemistry (Russia), PhD

## Accreditation

Northeastern University has maintained its status as a member in good standing of the New England Commission of Higher Education, Inc., previously New England Association of Schools and Colleges, since it was awarded its initial accreditation in 1940. The university was last reviewed by NECHE in 2018 and will be reviewed again in fall 2028.

### Bouvé College of Health Sciences

Program	Accrediting Agency
BA Public Health (Boston) ( <a href="https://catalog.northeastern.edu/undergraduate/health-sciences/community-health-behavioral-sciences/#departmentofhealthsciences">https://catalog.northeastern.edu/undergraduate/health-sciences/community-health-behavioral-sciences/#departmentofhealthsciences</a> )	Council on Education for Public Health (CEPH) ( <a href="https://ceph.org/">https://ceph.org/</a> )
BS Health Science (Boston) ( <a href="https://catalog.northeastern.edu/undergraduate/health-sciences/community-health-behavioral-sciences/#departmentofhealthsciences">https://catalog.northeastern.edu/undergraduate/health-sciences/community-health-behavioral-sciences/#departmentofhealthsciences</a> )	Council on Education for Public Health (CEPH) ( <a href="https://ceph.org/">https://ceph.org/</a> )
MPH Public Health (Boston, Charlotte) ( <a href="https://catalog.northeastern.edu/graduate/health-sciences/community-health-behavioral-sciences/#departmentofhealthsciences">https://catalog.northeastern.edu/graduate/health-sciences/community-health-behavioral-sciences/#departmentofhealthsciences</a> )	Council on Education for Public Health (CEPH) ( <a href="https://ceph.org/">https://ceph.org/</a> )
BSN Nursing (Boston, Charlotte) ( <a href="https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/#programstext">https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/#programstext</a> )	Commission on Collegiate Nursing Education (CCNE) ( <a href="https://www.aacnnursing.org/CCNE/">https://www.aacnnursing.org/CCNE/</a> )
BSN Nursing (Boston) ( <a href="https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/bsn/">https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/bsn/</a> ) <sup>2</sup>	Massachusetts Board of Registration in Nursing ( <a href="https://www.mass.gov/orgs/board-of-registration-in-nursing/">https://www.mass.gov/orgs/board-of-registration-in-nursing/</a> ) <sup>2</sup>
BSN Nursing—Transfer Track (Boston, Charlotte) ( <a href="https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/#programstext">https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/#programstext</a> )	Commission on Collegiate Nursing Education (CCNE) ( <a href="https://www.aacnnursing.org/CCNE/">https://www.aacnnursing.org/CCNE/</a> )
BSN Nursing—Transfer Track (Boston) ( <a href="https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/nursing-bsn-transfer-track-bos/">https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/nursing-bsn-transfer-track-bos/</a> ) <sup>2</sup>	Massachusetts Board of Registration in Nursing ( <a href="https://www.mass.gov/orgs/board-of-registration-in-nursing/">https://www.mass.gov/orgs/board-of-registration-in-nursing/</a> ) <sup>2</sup>
BSN Nursing—Transfer Track (Charlotte) ( <a href="https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/nursing-bsn-transfer-track/">https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/nursing-bsn-transfer-track/</a> ) <sup>3</sup>	North Carolina Board of Nursing ( <a href="https://www.ncbon.com/">https://www.ncbon.com/</a> ) <sup>3</sup>
BSN Nursing, Accelerated Program for Second-Degree Students (Boston, Charlotte) ( <a href="https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/#programstext">https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/#programstext</a> ) <sup>2</sup>	Commission on Collegiate Nursing Education (CCNE) ( <a href="https://www.aacnnursing.org/CCNE/">https://www.aacnnursing.org/CCNE/</a> ) <sup>2</sup>
BSN Nursing, Accelerated Program for Second-Degree Students (Boston) ( <a href="https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/accelerated-second-degree-students-bsn-bos/">https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/accelerated-second-degree-students-bsn-bos/</a> ) <sup>2</sup>	Massachusetts Board of Registration in Nursing ( <a href="https://www.mass.gov/orgs/board-of-registration-in-nursing/">https://www.mass.gov/orgs/board-of-registration-in-nursing/</a> ) <sup>2</sup>
BSN Nursing, Accelerated Program for Second-Degree Students (Charlotte) ( <a href="https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/accelerated-second-degree-students-bsn/">https://catalog.northeastern.edu/undergraduate/health-sciences/nursing/accelerated-second-degree-students-bsn/</a> ) <sup>3</sup>	North Carolina Board of Nursing ( <a href="https://www.ncbon.com/">https://www.ncbon.com/</a> ) <sup>3</sup>
MS Nursing (Boston) ( <a href="https://catalog.northeastern.edu/graduate/health-sciences/nursing/ms/">https://catalog.northeastern.edu/graduate/health-sciences/nursing/ms/</a> )	Commission on Collegiate Nursing Education (CCNE) ( <a href="https://www.aacnnursing.org/CCNE/">https://www.aacnnursing.org/CCNE/</a> )
MS Nursing—Direct Entry (Boston) ( <a href="https://catalog.northeastern.edu/graduate/health-sciences/nursing/nursing-direct-entry-ms/">https://catalog.northeastern.edu/graduate/health-sciences/nursing/nursing-direct-entry-ms/</a> )	Commission on Collegiate Nursing Education (CCNE) ( <a href="https://www.aacnnursing.org/CCNE/">https://www.aacnnursing.org/CCNE/</a> )
MS Nursing—Direct Entry (Boston) ( <a href="https://catalog.northeastern.edu/graduate/health-sciences/nursing/nursing-direct-entry-ms/">https://catalog.northeastern.edu/graduate/health-sciences/nursing/nursing-direct-entry-ms/</a> ) <sup>2</sup>	Massachusetts Board of Registration in Nursing ( <a href="https://www.mass.gov/orgs/board-of-registration-in-nursing/">https://www.mass.gov/orgs/board-of-registration-in-nursing/</a> ) <sup>2</sup>
MS Nursing Leadership (Boston) ( <a href="https://catalog.northeastern.edu/graduate/health-sciences/nursing/nursing-leadership-ms/">https://catalog.northeastern.edu/graduate/health-sciences/nursing/nursing-leadership-ms/</a> )	Commission on Collegiate Nursing Education (CCNE) ( <a href="https://www.aacnnursing.org/CCNE/">https://www.aacnnursing.org/CCNE/</a> )
DNP Nursing (Boston) ( <a href="https://catalog.northeastern.edu/graduate/health-sciences/nursing/nursing-dnp-bse/">https://catalog.northeastern.edu/graduate/health-sciences/nursing/nursing-dnp-bse/</a> )	Commission on Collegiate Nursing Education (CCNE) ( <a href="https://www.aacnnursing.org/CCNE/">https://www.aacnnursing.org/CCNE/</a> )
DNP Nurse Anesthesia (Boston) ( <a href="https://catalog.northeastern.edu/graduate/health-sciences/nursing/nurse-anesthesia-dnp/">https://catalog.northeastern.edu/graduate/health-sciences/nursing/nurse-anesthesia-dnp/</a> )	Council on Accreditation of Nurse Anesthesia Educational Programs (COA) ( <a href="https://www.coacrn.org/">https://www.coacrn.org/</a> )
DNP Nurse Anesthesia (Boston) ( <a href="https://catalog.northeastern.edu/graduate/health-sciences/nursing/nurse-anesthesia-dnp/">https://catalog.northeastern.edu/graduate/health-sciences/nursing/nurse-anesthesia-dnp/</a> )	Commission on Collegiate Nursing Education (CCNE) ( <a href="https://www.aacnnursing.org/CCNE/">https://www.aacnnursing.org/CCNE/</a> )

DNP Nurse Anesthesia (Boston) (<https://catalog.northeastern.edu/graduate/health-sciences/nursing/nurse-anesthesia-dnp/>)

International Federation of Nurse Anesthetists ([https://nam12.safelinks.protection.outlook.com/?url=https%3A%2F%2Fifna.site%2Fanesthesia%2Fnortheastern-university-nurse-anesthesia-program-boston-ma-usa%2F&data=05%7C02%7Cv.wallace%40northeastern.edu%7Cc66dd960e9014edc172d08dda499e253%7Ca8eec281aaa34daec9b9a398b9215%7CTWFpbGZsb3d8eyJfbXB0eU1hcGkiOnRydWUsIYiOiwLjAuMDAwMCIsIaIoiJXav">https://nam12.safelinks.protection.outlook.com/?url=https%3A%2F%2Fifna.site%2Fanesthesia%2Fnortheastern-university-nurse-anesthesia-program-boston-ma-usa%2F&data=05%7C02%7Cv.wallace%40northeastern.edu%7Cc66dd960e9014edc172d08dda499e253%7Ca8eec281aaa34daec9b9a398b9215%7CTWFpbGZsb3d8eyJfbXB0eU1hcGkiOnRydWUsIYiOiwLjAuMDAwMCIsIaIoiJXav">\)](https://nam12.safelinks.protection.outlook.com/?url=https%3A%2F%2Fifna.site%2Fanesthesia%2Fnortheastern-university-nurse-anesthesia-program-boston-ma-usa%2F&data=05%7C02%7Cv.wallace%40northeastern.edu%7Cc66dd960e9014edc172d08dda499e253%7Ca8eec281aaa34daec9b9a398b9215%7CTWFpbGZsb3d8eyJfbXB0eU1hcGkiOnRydWUsIYiOiwLjAuMDAwMCIsIaIoiJXav)

DNP Nursing Practice—Post-Master's (Boston) (<https://catalog.northeastern.edu/graduate/health-sciences/nursing/nursing-practice-dnp/>)

Commission on Collegiate Nursing Education (CCNE) (<https://www.aacnnursing.org/CCNE/>)

CAGS Nursing (multiple concentrations, Boston) (<https://nextcatalog.northeastern.edu/graduate/health-sciences/nursing/#programstext>)

Commission on Collegiate Nursing Education (CCNE) (<https://www.aacnnursing.org/CCNE/>)

Graduate Certificate Primary Care Nursing FNP (Boston) (<https://catalog.northeastern.edu/graduate/health-sciences/nursing/primary-care-nursing-fnp-graduate-certificate/>)

Commission on Collegiate Nursing Education (CCNE) (<https://www.aacnnursing.org/CCNE/>)

MS Physician Assistant Studies (Boston) (<https://catalog.northeastern.edu/graduate/health-sciences/clinical-rehabilitation-sciences/physician-assistant-studies-ms/>)

Accreditation Review Commission on Education for the Physician Assistant, Inc. (ARC-PA) (<http://www.arc-pa.org/>)

MS Speech-Language Pathology (Boston, Charlotte) (<https://nextcatalog.northeastern.edu/graduate/health-sciences/clinical-rehabilitation-sciences/#communicationsciencesanddisorderstext>)

Council on Academic Accreditation in Audiology and Speech-Language Pathology (CAA) of the American Speech-Language-Hearing Association (ASHA) (<https://caa.asha.org/>)

MS Speech-Language Pathology (Boston) (<https://catalog.northeastern.edu/graduate/health-sciences/clinical-rehabilitation-sciences/speech-language-pathology-ms/>)<sup>1</sup>

Massachusetts Department of Elementary and Secondary Education (<https://www.doe.mass.edu/>)<sup>1</sup>

MS Speech-Language Pathology—Connect (Boston, Charlotte) (<https://nextcatalog.northeastern.edu/graduate/health-sciences/clinical-rehabilitation-sciences/#communicationsciencesanddisorderstext>)

Council on Academic Accreditation in Audiology and Speech-Language Pathology (CAA) of the American Speech-Language-Hearing Association (ASHA) (<https://caa.asha.org/>)

MS Speech-Language Pathology—Connect (Boston) (<https://nextcatalog.northeastern.edu/graduate/health-sciences/clinical-rehabilitation-sciences/speech-language-pathology-ms-connect-bos/>)<sup>1</sup>

Massachusetts Department of Elementary and Secondary Education (<https://www.doe.mass.edu/>)<sup>1</sup>

DPT Physical Therapy (Boston) (<https://catalog.northeastern.edu/graduate/health-sciences/clinical-rehabilitation-sciences/dpt-post-baccalaureate-entry/>)

Commission on Accreditation in Physical Therapy Education (CAPTE) (<https://www.capteonline.org/>)

PharmD Pharmacy (Boston) (<https://catalog.northeastern.edu/graduate/health-sciences/pharmacy/pharmd-direct-entry/>)

Accreditation Council for Pharmacy Education (ACPE) (<https://www.acpe-accredit.org/>)

PhD Counseling Psychology (Boston) (<https://catalog.northeastern.edu/graduate/health-sciences/community-health-behavioral-sciences/counseling-psychology-phd/>)

American Psychological Association (APA) ([https://accreditation.apa.org/accredited-programs/?\\_gl=1\\*iljb96\\*\\_ga\\*Njl5NzI0OTk4LjE2OTI3MjI0OTQ.\\*\\_ga\\_SZLGDJGNB\\*MTY5MjcyMjQ](https://accreditation.apa.org/accredited-programs/?_gl=1*iljb96*_ga*Njl5NzI0OTk4LjE2OTI3MjI0OTQ.*_ga_SZLGDJGNB*MTY5MjcyMjQ))

PhD School Psychology (Boston) (<https://catalog.northeastern.edu/graduate/health-sciences/community-health-behavioral-sciences/school-psychology-phd/>)

American Psychological Association (APA) ([https://accreditation.apa.org/accredited-programs/?\\_gl=1\\*iljb96\\*\\_ga\\*Njl5NzI0OTk4LjE2OTI3MjI0OTQ.\\*\\_ga\\_SZLGDJGNB\\*MTY5MjcyMjQ](https://accreditation.apa.org/accredited-programs/?_gl=1*iljb96*_ga*Njl5NzI0OTk4LjE2OTI3MjI0OTQ.*_ga_SZLGDJGNB*MTY5MjcyMjQ))

PhD School Psychology (Boston) (<https://catalog.northeastern.edu/graduate/health-sciences/community-health-behavioral-sciences/school-psychology-phd/>)

National Association of School Psychologists (NASP) (<https://www.nasponline.org/>)

CAGS School Psychology (Boston) (<https://catalog.northeastern.edu/graduate/health-sciences/community-health-behavioral-sciences/school-psychology-cags/>)

National Association of School Psychologists (NASP) (<https://www.nasponline.org/>)

CAGS School Psychology (Boston) (<https://catalog.northeastern.edu/graduate/health-sciences/community-health-behavioral-sciences/school-psychology-cags/>)<sup>1</sup>

Massachusetts Department of Elementary and Secondary Education (<https://www.doe.mass.edu/>)<sup>1</sup>

<sup>1</sup> The Massachusetts Department of Elementary and Secondary Education approves (not accredits) programs.

<sup>2</sup> The Massachusetts Board of Registration in Nursing approves (not accredits) programs.

<sup>3</sup> The North Carolina Board of Nursing approves (not accredits) programs.

## College of Arts, Media and Design

### Program

Master of Architecture (Boston) (<https://catalog.northeastern.edu/graduate/arts-media-design/architecture/#text>)

### Accrediting Agency

National Architectural Accrediting Board (NAAB) (<https://www.naab.org/>)

## College of Engineering

- BSBioE Bioengineering (Boston) (<https://catalog.northeastern.edu/undergraduate/engineering/bioengineering/bioengineering-bsbioe/>)
  - The BS in Bioengineering is accredited by the Engineering Accreditation Commission of ABET (<https://www.abet.org/>) under the commission's General Criteria and Program Criteria for Bioengineering and Biomedical and Similarly Named Engineering programs.
- BSChE Chemical Engineering (Boston) (<https://catalog.northeastern.edu/undergraduate/engineering/chemical/chemical-engineering-bsche/>)
  - The BS in Chemical Engineering is accredited by the Engineering Accreditation Commission of ABET (<https://www.abet.org/>) under the commission's General Criteria and Program Criteria for Chemical, Biochemical, Biomolecular, and Similarly Named Engineering Programs.
- BSCE Civil Engineering (Boston) (<https://catalog.northeastern.edu/undergraduate/engineering/civil-environmental/civil-engineering-bsce/>)
  - The BS in Civil Engineering is accredited by the Engineering Accreditation Commission of ABET (<https://www.abet.org/>) under the commission's General Criteria and Program Criteria for Civil and Similarly Named Engineering Programs.
- BSCmpE Computer Engineering (Boston) (<https://catalog.northeastern.edu/undergraduate/engineering/electrical-computer/computer-engineering-bscompe/>)
  - The BS in Computer Engineering is accredited by the Engineering Accreditation Commission of ABET (<https://www.abet.org/>) under the commission's General Criteria and Program Criteria for Electrical, Computer, Communications, Telecommunication(s), and Similarly Named Engineering Programs.
- BSEE Electrical Engineering (Boston) (<https://catalog.northeastern.edu/undergraduate/engineering/electrical-computer/electrical-engineering-bsee/>)
  - The BS in Electrical Engineering is accredited by the Engineering Accreditation Commission of ABET (<https://www.abet.org/>) under the commission's General Criteria and Program Criteria for Electrical, Computer, Communications, Telecommunication(s), and Similarly Named Engineering Programs.
- BSEnvE Environmental Engineering (Boston) (<https://catalog.northeastern.edu/undergraduate/engineering/civil-environmental/environmental-engineering-bsenv/>)
  - The BS in Environmental Engineering is accredited by the Engineering Accreditation Commission of ABET (<https://www.abet.org/>) under the commission's General Criteria and Program Criteria for Environmental Engineering and Similarly Named Engineering Programs.
- BSIE Industrial Engineering (Boston) (<https://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/bsie/>)
  - The BS in Industrial Engineering is accredited by the Engineering Accreditation Commission of ABET (<https://www.abet.org/>) under the commission's General Criteria and Program Criteria for Industrial and Similarly Named Engineering Programs.
- BSME Mechanical Engineering (Boston) (<https://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/bsme/>)
  - The BS in Mechanical Engineering is accredited by the Engineering Accreditation Commission of ABET (<https://www.abet.org/>) under the commission's General Criteria and Program Criteria for Mechanical and Similarly Named Engineering Programs.

## College of Science

### Program

BS Biochemistry (Boston) (<https://catalog.northeastern.edu/undergraduate/science/biochemistry/biochemistry-bs/>)

### Accrediting Agency

American Society for Biochemistry and Molecular Biology (ASBMB) (<https://www.asbmb.org/>)

## College of Professional Studies

### Program

BS Finance and Accounting Management (Boston) (<https://catalog.northeastern.edu/professional-studies/bachelors-postbaccalaureate/finance-accounting-management/>)<sup>1</sup>

### Accrediting Agency

AACSB International—The Association to Advance Collegiate Schools of Business (<https://www.aacsb.edu/>)

BS Management (Boston) (<https://catalog.northeastern.edu/professional-studies/bachelors-postbaccalaureate/management/>)<sup>1</sup>

AACSB International—The Association to Advance Collegiate Schools of Business (<https://www.aacsb.edu/>)

BSET Computer Engineering Technology

Accredited by the Technology Accreditation Commission of ABET, 111 Market Place Suite 1050 Baltimore, MD 21202-4012 Telephone: 410.347.7700 (<https://www.abet.org/>)

BSET Electrical Engineering Technology

Accredited by the Technology Accreditation Commission of ABET, 111 Market Place Suite 1050 Baltimore, MD 21202-4012 Telephone: 410.347.7700 (<https://www.abet.org/>)

BSET Mechanical Engineering Technology	Accredited by the Technology Accreditation Commission of ABET, 111 Market Place Suite 1050 Baltimore, MD 21202-4012 Telephone: 410.347.7700 ( <a href="https://www.abet.org/">https://www.abet.org/</a> )
MS Organizational Leadership (Boston), with concentration in Project Management ( <a href="https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/organizational-leadership-ms/">https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/organizational-leadership-ms/</a> )	Project Management Institute's Global Accreditation Center ( <a href="https://www.pmi.org/global-accreditation-center/">https://www.pmi.org/global-accreditation-center/</a> )
MS Project Management (Arlington, Boston, Miami, Portland, Seattle, Silicon Valley, Toronto) ( <a href="https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/#programstext">https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/#programstext</a> )	Project Management Institute's Global Accreditation Center ( <a href="https://www.pmi.org/global-accreditation-center/">https://www.pmi.org/global-accreditation-center/</a> )
MSLD Sports Leadership (Boston) ( <a href="https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/master-of-sports-leadership/">https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/master-of-sports-leadership/</a> )	Commission on Sport Management Accreditation ( <a href="https://www.cosmaweb.org/">https://www.cosmaweb.org/</a> )
Master of Arts in Teaching (Boston) programs in: ( <a href="https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/#programstext">https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/#programstext</a> )	
Elementary Education, 1–6	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> ) <sup>2</sup>
Sheltered English Immersion Administrator—Endorsement	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> )
Sheltered English Immersion Teacher—Endorsement	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> ) <sup>2</sup>
Teacher of Biology, 8–12	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> ) <sup>2</sup>
Teacher of Chemistry, 8–12	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> ) <sup>2</sup>
Teacher of Earth and Space Science, 8–12	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> ) <sup>2</sup>
Teacher of English, 5–12	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> ) <sup>2</sup>
Teacher of English as a Second Language, PreK–6, 5–12	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> ) <sup>2</sup>
Teacher of History, 5–12	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> ) <sup>2</sup>
Teacher of Mathematics, 8–12	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> ) <sup>2</sup>
Teacher of Physics, 8–12	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> ) <sup>2</sup>
Teacher of Political Science/Political Philosophy, 8–12	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> ) <sup>2</sup>
Teacher of Social Science, 5–12	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> ) <sup>2</sup>
Teacher of Students with Moderate Disabilities, PreK–8, 5–12	Massachusetts Department of Elementary and Secondary Education ( <a href="https://www.doe.mass.edu/">https://www.doe.mass.edu/</a> ) <sup>2</sup>

<sup>1</sup> Accredited under the aegis of the “sponsoring” full-time college.

<sup>2</sup> The Massachusetts Department of Elementary and Secondary Education approves (not accredits) programs.

## College of Social Sciences and Humanities

Program	Accrediting Agency
BS American Sign Language—English Interpreting (Boston) ( <a href="https://catalog.northeastern.edu/undergraduate/social-sciences-humanities/cultures-societies-global-studies/american-sign-language-english-interpreting-bs/">https://catalog.northeastern.edu/undergraduate/social-sciences-humanities/cultures-societies-global-studies/american-sign-language-english-interpreting-bs/</a> )	Commission on Collegiate Interpreter Education ( <a href="http://www.ccie-accreditation.org/">http://www.ccie-accreditation.org/</a> )
MPA Public Administration (Arlington, Boston, Oakland) ( <a href="https://catalog.northeastern.edu/graduate/social-sciences-humanities/public-policy-urban-affairs/#programstext">https://catalog.northeastern.edu/graduate/social-sciences-humanities/public-policy-urban-affairs/#programstext</a> )	Network of Schools of Public Policy, Affairs, and Administration ( <a href="https://www.naspaa.org/">https://www.naspaa.org/</a> )

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**D'Amore-McKim School of Business****Program**

All programs offered in 2025–2026

**Accrediting Agency**

AACSB International—Association to Advance Collegiate Schools of Business (<https://www.aacsb.edu/>)

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**School of Law****Program**

JD Law (Boston) (<https://catalog.northeastern.edu/graduate/law/law-jd/>) American Bar Association; Association of American Law Schools<sup>1</sup>

<sup>1</sup> The Association of American Law Schools is an elected membership organization, not an accrediting body.

## Authorizations

Northeastern University's degree-granting authority is rooted in its charter, which was established by an act of the Massachusetts Legislature in 1916.

### Campus Locations and Regulatory Agencies

In addition to accreditation by the New England Commission of Higher Education, Northeastern University is regulated by local authorities for its global campus network locations. These agencies are as follows:

- Arlington, Virginia
  - State Council of Higher Education for Virginia
- Charlotte, North Carolina
  - Board of Governors of the University of North Carolina
- Miami, Florida
  - Florida Commission for Independent Education
- Portland, Maine
  - Maine Department of Education
- Oakland, California
  - Bureau for Private Postsecondary Education
- San Jose, California
  - Bureau for Private Postsecondary Education
- Seattle, Washington
  - Washington Student Achievement Council
- Toronto, Ontario, Canada
  - Ministry of Colleges, Universities, Research Excellence and Security
- Vancouver, British Columbia, Canada
  - Ministry of Post-Secondary Education and Future Skills

### Required Disclosures

#### VIRGINIA

Northeastern has processes in place to ensure that student grievances are treated with respect and addressed in a fair and professional manner. Students can report concerns to the Office of Student Conduct and Conflict Resolution (<https://www.northeastern.edu/osccr/>) or the Office of the University Ombuds for Graduate Students (<https://graduateombuds.northeastern.edu/>). At the Arlington campus, students can contact the on-site student support specialist or the campus principal.

If a student's problem has not been resolved in pursuance of the Northeastern grievance policy, they may contact the State Council of Higher Education for Virginia. SCHEV representatives can be reached via telephone at (804) 225-2600; via fax at (804) 225-2604; at this website (<https://www.schev.edu/students/resources/student-complaints/>); or by mail at 101 N. 14th Street, 10th Floor, James Monroe Building, Richmond, VA 23219.

The Virginia State Approving Agency is the approving authority of education and training programs for Virginia. Our office investigates complaints of GI Bill® beneficiaries. While most complaints should initially follow the school grievance policy, if the situation cannot be resolved at the school, the beneficiary should contact our office via email [saa@dvs.virginia.gov](mailto:saa@dvs.virginia.gov). *GI Bill® is a registered trademark of the U.S. Department of Veterans Affairs. More information about education benefits offered by VA is available at the official U.S. government website at [http://www.benefits.va.gov/gibill/](http://www.benefits.va.gov/gibill).*

#### NORTH CAROLINA

Northeastern has been evaluated by the University of North Carolina and is licensed to conduct higher education degree activity in the state. The university's guaranty bond for unearned prepaid tuition is on file with the Board of Governors of the University of North Carolina and the Office of the General Counsel at Northeastern. North Carolina students may view a copy of the Tuition Guaranty Bond by contacting Northeastern's Risk Services at 716 Columbus Avenue (Columbus Place), Suite 301 CP, Boston, MA 02120.

If students are unable to resolve a complaint offered by the Northeastern grievance procedures, they can submit a complaint through the online student complaint form at <https://studentcomplaints.northcarolina.edu/form> (<https://studentcomplaints.northcarolina.edu/form/>), or by mail to North Carolina Post-Secondary Education Complaints, 140 Friday Center Drive, Chapel Hill, NC 27517. <https://www.northcarolina.edu/post-secondary-education-complaints/>.

#### FLORIDA

Northeastern University—Miami is accredited by the New England Commission of Higher Education and is provisionally licensed in the state of Florida by the Commission on Independent Education. Additional information regarding the institution may be obtained by contacting the Commission for Independent Education, Department of Education, 325 West Gaines Street, Suite 1414, Tallahassee, Florida 32399-0400, toll-free telephone number (888) 224-6684.

The transferability of credits you earn at Northeastern is at the complete discretion of an institution to which you may seek to transfer. Acceptance of the degree you earn in the educational program is also at the complete discretion of the institution to which you may seek to transfer. If the credits or degree that you earn at this institution are not accepted at the institution to which you seek to transfer, you may be required to repeat some or all of your coursework at that institution. For this reason you should make certain that your attendance at this institution will meet your educational goals. This may include contacting an institution to which you may seek to transfer after attending Northeastern to determine if your credits or degree will transfer.

## CALIFORNIA

Any questions a student may have regarding this catalog that have not been satisfactorily answered by the institution may be directed to the Bureau for Private Postsecondary Education (<http://www.bppe.ca.gov>), 1747 N. Market Blvd., Ste. 225, Sacramento, CA 95834; P.O. Box 980818, West Sacramento, CA 95798-0818, (888) 370-7589, or by fax (916) 263-1897.

### **NOTICE CONCERNING TRANSFERABILITY OF CREDITS AND CREDENTIALS EARNED AT OUR INSTITUTION**

The transferability of credits you earn at Northeastern is at the complete discretion of an institution to which you may seek to transfer. Acceptance of the degree you earn in the educational program is also at the complete discretion of the institution to which you may seek to transfer. If the credits or degree that you earn at this institution are not accepted at the institution to which you seek to transfer, you may be required to repeat some or all of your coursework at that institution. For this reason you should make certain that your attendance at this institution will meet your educational goals. This may include contacting an institution to which you may seek to transfer after attending Northeastern to determine if your credits or degree will transfer.

The Office of Student Assistance and Relief is available to support prospective students, current students, or past students of private postsecondary educational institutions in making informed decisions, understanding their rights, and navigating available services and relief options. The office may be reached by calling (888) 370-7589 or by visiting <https://osar.bppe.ca.gov/>.

## WASHINGTON

Northeastern is authorized by the Washington Student Achievement Council and meets the requirements and minimum educational standards established for degree-granting institutions under the Degree-Granting Institutions Act. This authorization is subject to periodic review and authorizes Northeastern to offer specific degree programs. The council may be contacted for a list of currently authorized programs. Authorization by the council does not carry with it an endorsement by the council of the institution or its programs. Any person desiring information about the requirements of the act or the applicability of those requirements to the institution may contact the council at P.O. Box 43430, Olympia, WA 98504-3430 or by email at [degreeauthorization@wsac.wa.gov](mailto:degreeauthorization@wsac.wa.gov).

The transferability of credits earned at Northeastern is at the discretion of the receiving college, university, or other educational institution. Students considering transferring to any institution should not assume that credits earned in any program of study at Northeastern will be accepted by the receiving institution. Similarly, the ability of a degree, certificate, diploma, or other academic credential earned at Northeastern to satisfy an admission requirement of another institution is at the discretion of the receiving institution. Accreditation does not guarantee credentials or credits earned at Northeastern will be accepted by or transferred to another institution. To minimize the risk of having to repeat coursework, students should contact the receiving institution in advance for evaluation and determination of transferability of credits and/or acceptability of degrees, diplomas, or certificates earned. The Washington Student Achievement Council has authority to investigate student complaints against specific schools. WSAC may not be able to investigate every student complaint. Visit <http://www.wsac.wa.gov/student-complaints> (<http://www.wsac.wa.gov/student-complaints/>) for information regarding the WSAC complaint process.

## ONTARIO

### **Master of Science in Project Management (<https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/project-management-ms-tor/>)**

This institution has been granted consent by the Minister of Colleges, Universities, Research Excellence and Security to offer this degree program for a five-year term starting July 28, 2021. Prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

### **Master of Science in Regulatory Affairs (<https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/regulatory-affairs-ms-tor/>)**

This institution has been granted consent by the Minister of Colleges, Universities, Research Excellence and Security to offer this degree program for a five-year term starting June 25, 2021. Prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

### **Master of Professional Studies in Analytics (<https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/analytics-mps-tor/>)**

This institution has been granted consent by the Minister of Colleges, Universities, Research Excellence and Security to offer this degree program for a five-year term starting March 6, 2020. Prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**Master of Professional Studies in Informatics (<https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/informatics-mps-tor/>)**

This institution has been granted consent by the Minister of Colleges, Universities, Research Excellence and Security to offer this degree program for a five-year term starting March 6, 2020. Prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**Master of Science in Information Systems (<https://catalog.northeastern.edu/graduate/engineering/multidisciplinary/information-systems-ms-tor/>)**

This institution has been granted consent by the Minister of Colleges, Universities, Research Excellence and Security to offer this degree program for a five-year term starting July 28, 2021. Prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**Master of Science in Biotechnology (<https://catalog.northeastern.edu/graduate/science/chemistry-chemical-biology/biotechnology-ms-tor/>)**

This institution has been granted consent by the Minister of Colleges, Universities, Research Excellence and Security to offer this degree program for a five-year term starting September 14, 2021. Prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**Master of Science in Cyber-Physical Systems (<https://catalog.northeastern.edu/graduate/engineering/multidisciplinary/cyber-physical-systems-ms-tor/>)**

This institution has been granted consent by the Minister of Colleges, Universities, Research Excellence and Security to offer this degree program for a five-year term starting January 18, 2023. Prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**Master of Science in Bioinformatics (<https://catalog.northeastern.edu/graduate/science/biology/bioinformatics-ms-tor/>)**

This institution has been granted consent by the Minister of Colleges, Universities, Research Excellence and Security to offer this degree program for a five-year term starting January 18, 2023. Prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**Master of Science in Software engineering systems (<https://catalog.northeastern.edu/graduate/engineering/multidisciplinary/software-engineering-systems-ms-tor/>)**

This institution has been granted consent by the Minister of Colleges, Universities, Research Excellence and Security to offer this degree program for a five-year term starting April 4, 2025. Prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**Master of Science in Data architecture and management (<https://catalog.northeastern.edu/graduate/engineering/multidisciplinary/data-architecture-management-ms-tor/>)**

This institution has been granted consent by the Minister of Colleges, Universities, Research Excellence and Security to offer this degree program for a five-year term starting April 4, 2025. Prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**BRITISH COLUMBIA****Master of Science in Computer Science (<https://catalog.northeastern.edu/graduate/computer-information-science/computer-science/computer-science-mscs-van/>)**

This program is offered under the written consent of the Minister of Post-Secondary Education and Future Skills effective July 7, 2019, having undergone a quality assessment process and been found to meet the criteria established by the minister. Nevertheless, prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**Align—Master of Science in Computer Science (<https://catalog.northeastern.edu/graduate/computer-information-science/computer-science/computer-science-mscs-align-van/>)**

This program is offered under the written consent of the Minister of Post-Secondary Education and Future Skills effective July 7, 2019, having undergone a quality assessment process and been found to meet the criteria established by the minister. Nevertheless, prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**Master of Science in Data Analytics Engineering (<https://catalog.northeastern.edu/graduate/engineering/mechanical-industrial/data-analytics-engineering-ms-van/>)**

This program is offered under the written consent of the Minister of Post-Secondary Education and Future Skills effective November 29, 2021, having undergone a quality assessment process and been found to meet the criteria established by the minister. Nevertheless,

prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**Master of Science in Information Design and Data Visualization (<https://catalog.northeastern.edu/graduate/arts-media-design/art-design/information-design-data-visualization-ms-van/>)**

This program is offered under the written consent of the Minister of Post-Secondary Education and Future Skills effective October 28, 2021, having undergone a quality assessment process and been found to meet the criteria established by the minister. Nevertheless, prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**Master of Professional Studies in Analytics (<https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/analytics-mps-van/>)**

This program is offered under the written consent of the Minister of Post-Secondary Education and Future Skills effective October 28, 2021, having undergone a quality assessment process and been found to meet the criteria established by the minister. Nevertheless, prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**MASTER OF SCIENCE IN INFORMATION SYSTEMS (<https://catalog.northeastern.edu/graduate/engineering/multidisciplinary/information-systems-msis-van/>)**

This program is offered under the written consent of the Minister of Post-Secondary Education and Future Skills effective March 3, 2023, having undergone a quality assessment process and been found to meet the criteria established by the minister. Nevertheless, prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (e.g., acceptable to potential employers, professional licensing bodies, or other educational institutions).

**MASTER OF professional studies in digital media (<https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/digital-media-mps-van/>) (including connect (<https://catalog.northeastern.edu/graduate/professional-studies/masters-degree-programs/digital-media-mps-connect-van/>))**

This program is offered under the written consent of the Minister of Post-Secondary Education and Future Skills effective June 6, 2023, having undergone a quality assessment process and been found to meet the criteria established by the minister. Nevertheless, prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (for example, acceptable to potential employers, professional licensing bodies, or other educational institutions).

**MASTER OF science in health informatics (<https://catalog.northeastern.edu/graduate/health-sciences/interdisciplinary/health-informatics-ms-van/>)**

This program is offered under the written consent of the Minister of Post-Secondary Education and Future Skills effective January 31, 2025, having undergone a quality assessment process and been found to meet the criteria established by the minister. Nevertheless, prospective students are responsible for satisfying themselves that the program and the degree will be appropriate to their needs (for example, acceptable to potential employers, professional licensing bodies, or other educational institutions).

Distance Education/State Authorization Reciprocity Agreement Student Complaint Procedures (<https://graduate.northeastern.edu/state-authorization-statements-and-complaint-resolution/>)

## Notifications and Disclosures

The *Northeastern University Catalog* contains the university's primary statements about approved academic programs and degree requirements, as authorized by the president or the Board of Trustees.

The *Northeastern University Catalog* contains current information about the university calendar, admissions, degree requirements, fees, and certain procedures and regulations; however, such information is not intended and should not be regarded to be contractual. Course information was current as of June 5, 2025. For updated course information, students and advisors should consult the Banner course catalog (<https://nubanner.neu.edu/StudentRegistrationSsb/ssb/term/termSelection/?mode=courseSearch>).

### Accreditation

Please visit the Accreditation (<https://catalog.northeastern.edu/graduate/appendix/statements-accreditation/>) page of this catalog for details of Northeastern University's accreditation status.

### FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT

In accordance with the Family Educational Rights and Privacy Act of 1974, Northeastern University permits its students to inspect their records wherever appropriate and to challenge specific parts of them when they feel it is necessary to do so. Specific details of the law as it applies to Northeastern are discussed in this section of the catalog (<https://catalog.northeastern.edu/graduate/academic-policies-procedures/ferpa/>).

### PERSISTENCE RATES UNDER THE STUDENT RIGHT-TO-KNOW ACT

In the fall of 2024, the persistence rate for undergraduate students who entered in the fall 2023 cohort was 96.9%.

### TUITION DEFAULT POLICY

In cases where the student defaults on their tuition, the student shall be liable for the outstanding tuition and all reasonable associated collection costs incurred by the university, including attorneys' fees.

### NONDISCRIMINATION POLICIES

Northeastern University is committed to providing a living, learning, and working environment free from discrimination and harassment and does not discriminate on the basis of race, color, religion, religious creed, genetic information, sex (including on the basis of sex stereotypes, sex characteristics, pregnancy, or related conditions), gender, gender identity, gender expression, sexual orientation, age, national origin, ancestry, ethnicity, disability, or veteran or military status in admission to, access to, treatment in, or employment in its programs and activities. The university will not tolerate any conduct that violates rights guaranteed by law, or any of the university policies that prohibit discrimination, including the Policy on Equal Opportunity ([https://www.northeastern.edu/policies/pdfs/Policy\\_on\\_Equal\\_Opportunity.pdf](https://www.northeastern.edu/policies/pdfs/Policy_on_Equal_Opportunity.pdf)), Policy on Sexual and Gender-Based Harassment and Title IX ([https://policies.northeastern.edu/policy104/#\\_ga=21399120526780236931685972406-9222403871666097079](https://policies.northeastern.edu/policy104/#_ga=21399120526780236931685972406-9222403871666097079)), and the Policy on Non-Fraternization ([https://www.northeastern.edu/policies/pdfs/Policy\\_on\\_Non-Fraternization.pdf](https://www.northeastern.edu/policies/pdfs/Policy_on_Non-Fraternization.pdf)). Furthermore, university policy also includes prohibitions of retaliation for filing complaints of discrimination with the Office for University Equity and Compliance. Links to the university's nondiscrimination policies and its grievance procedures are available at the OUEC (<https://www.northeastern.edu/ouec/>). Inquiries regarding the university's nondiscrimination policies may be directed to:

Office for University Equity and Compliance (<https://ouec.northeastern.edu/>)  
 Mark Jannoni, Assistant Vice President and Title IX Coordinator  
 125 Richards Hall  
 Northeastern University  
 Boston, Massachusetts 02115  
 617.373.4644  
 ouec@northeastern.edu

The university strongly encourages any person to report information relating to alleged discrimination or harassment to the OUEC (<https://ouec.northeastern.edu/>) by completing the form available here (<https://web.studentally.com/#/report/northeastern>) or through any of the contact options listed above. OUEC's policies, as well as other helpful information, can be found at the OUEC website (<https://ouec.northeastern.edu/>).

### DISABILITY ACCESS SERVICES

Disability Access Services (<https://drc.sites.northeastern.edu/>) provides a variety of disability-related services and accommodations to Northeastern University's students with documented disabilities.

Northeastern's compliance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 are coordinated by the senior director of Disability Access Services. Persons requiring information regarding Disability Access Services should contact the center at 617.373.2675 or at DASBoston@northeastern.edu.

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**CLERY ACT**

Northeastern University is committed to assisting all members of the university community in providing for their own safety and security. Information regarding campus security and personal safety, including topics such as crime prevention, university police law enforcement authority, crime reporting policies, crime statistics for the most recent three-year period, and disciplinary procedures, is available in the Annual Security & Fire Safety Reports, located on the NUPD website (<https://nupd.northeastern.edu/annual-reports/>).

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**EMERGENCY INFORMATION**

The university is prepared to respond to emergencies and urgent situations that require immediate action with a trained team of police officers, EMTs, health and counseling experts, student affairs and residential life staff, and other professionals from a coordinated group that is able to manage a wide range of potential situations.

In case of emergency or crisis situations that require immediate notification, university officials will deploy the NU Alert system, which sends email, voicemail, and text messages to students, faculty, and staff. NU Alert is intended to communicate pertinent information and, when appropriate, provide directions to those in the affected area(s).

A record of past Timely Warning and NU Alert Emergency Notifications for our campus community can be found on the NUPD website (<https://nupd.northeastern.edu/safety-notifications/>).

Examples of crisis situations range from snowstorms to national emergencies that have a local impact.

Additional information on the university's emergency information systems can be found on the university's Emergency information (<https://www.northeastern.edu/emergency-information/>) website.

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**MISSION STATEMENT**

To educate students for a life of fulfillment and accomplishment.

To create and translate knowledge to meet global and societal needs.

## Major CIP Codes

The following is a list of Northeastern University majors for programs accepting new students for the 2025-2026 catalog year, along with each major's corresponding CIP code. "CIP" refers to the Classification of Instructional Programs published by the U.S. Department of Education's National Center for Education Statistics (<https://nces.ed.gov/ipeds/cipcode/Default.aspx?y=56>).

Academic Program	Major Transcript Title	Major Cip Code
P-CERTG-3DAN: 3D Animation, Graduate Certificate	3D Animation	100304
CERTG-ACFD: Accounting and Financial Decision Making, Graduate Certificate	Accntng Fin Decision Making	520899
MSA-ACCT: Accounting, MSA	Accounting	520301
P-CERTU-ACCT: Accounting, Undergraduate Certificate	Accounting	520301
P-CERTU-AACT: Advanced Accounting, Undergraduate Certificate	Advanced Accounting	520301
MS-AIMF: Advanced and Intelligent Manufacturing, MS	Advanced and Intelligent Mfg	143601
P-BS-AVMS: Advanced Manufacturing Systems, BS	Advanced Manufacturing Systems	150613
BA-AFMS: Africana Studies and Media and Screen Studies, BA	Africana St/Media Screen St	050201
BA-AFHS: Africana Studies and Human Services, BA	Africana Stud/Human Services	050201
BA-AFCS: Africana Studies, BA	Africana Studies	050201
BA-AFEN: Africana Studies and English, BA	Africana Studies/English	050201
BA-AFJO: Africana Studies and Journalism, BA	Africana Studies/Journalism	050201
BA-AFPS: Africana Studies and Political Science, BA	Africana Studies/Political Sci	050201
P-CERTG-AGPM: Agile Project Management, Graduate Certificate	Agile Project Management	520211
CERTG-AIAP: AI Applications, Graduate Certificate	AI Applications	110105
P-BS-ANLY: Analytics, BS	Analytics	110802
P-CERTU-ANLY: Analytics, Undergraduate Certificate	Analytics	110802
P-MPS-ANLY: Analytics, MPS	Analytics	110802
MS-AQMS: Applied Quantitative Methods and Social Analysis, MS	Appl Quant Methods Soc Anlys	450102
MPS-APAI: Applied AI, MPS	Applied AI	110102
MPS-APAI-C: Applied AI—Connect, MPS	Applied AI	110102
P-CERTG-APAN: Applied Analytics, Graduate Certificate	Applied Analytics	307101
MS-ABA: Applied Behavior Analysis, MS	Applied Behavior Analysis	422814
MS-AEPP: Applied Educational Psychology, MS	Applied Educational Psychology	422805
P-MPS-APLG: Applied Logistics, MPS	Applied Logistics	520203
P-MPS-APMI: Applied Machine Intelligence, MPS	Applied Machine Intelligence	521301
CERTG-AMTH: Applied Mathematics, Graduate Certificate	Applied Mathematics	270301
MS-AMTH: Applied Mathematics, MS	Applied Mathematics	270301
MS-APNR: Applied Nursing Research, MS	Applied Nursing Research	513808
BS-APHY: Applied Physics, BS	Applied Physics	400801
MS-APEN: Applied Physics and Engineering, MS	Applied Physics/Engineering	400801
MS-APPS: Applied Psychology, MS	Applied Psychology	422813
CERTG-APSC: Applied Psychology in Context, Graduate Certificate	Applied Psychology in Context	422813

BS-ASBA: Architectural Studies and Business Administration, BS	Arch Studies/Business Admin	040801
BS-ARCS: Architectural Studies, BS	Architectural Studies	040801
BS-ARSD: Architectural Studies and Design, BS	Architectural Studies/Design	040803
BS-ARCH: Architecture, BS	Architecture	040902
MARCH-ARCH1: Master of Architecture—One-Year Program	Architecture	040902
MARCH-ARCH2: Master of Architecture—Two-Year Program	Architecture	040902
MARCH-ARCH3: Master of Architecture—Three-Year Program	Architecture	040902
MARCH-ARCH3A: Master of Architecture—Three-Year Program—Advanced Degree Entrance	Architecture	040902
BS-AENG: Architecture and English, BS	Architecture/English	040201
BA-ARTS: Art, BA	Art	500702
MS-ARIN: Artificial Intelligence, MS	Artificial Intelligence	110102
MS-AMCE: Arts Administration and Cultural Entrepreneurship, MS	Arts Adm Cultural Entrepren	501099
CERTG-ARAD: Arts Administration, Graduate Certificate	Arts Administration	501099
BS-ASLI: American Sign Language—English Interpreting, BS	ASL - English Interpreting	161601
BS-ASHU: American Sign Language and Human Services, BS	ASL/Human Services	161601
BS-ASLN: American Sign Language and Linguistics, BS	ASL/Linguistics	161601
BS-ASPS: American Sign Language and Psychology, BS	ASL/Psychology	161601
BS-ASTH: American Sign Language and Theatre, BS	ASL/Theatre	161601
BS-BNPH: Behavioral Neuroscience and Philosophy, BS	Behav Neuroscience/Philosophy	261501
BS-BENS: Behavioral Neuroscience, BS	Behavioral Neuroscience	261501
BS-BNDS: Behavioral Neuroscience and Design, BS	Behavioral Neuroscience/Design	261501
BS-BIOC: Biochemistry, BS	Biochemistry	260202
CERTG-BDBS: Biodefense and Biosecurity, Graduate Certificate	Biodefense and Biosecurity	261201
BSBIOE-BEBN: Bioengineering and Behavioral Neuroscience, BSBioE	Bioeng/Behavioral Neuroscience	149999
BSBIOE-BION: Bioengineering, BSBioE	Bioengineering	149999
MSBIOE-BION: Bioengineering, MSBioE	Bioengineering	149999
MSBIOE-BIONC: Bioengineering, MSBioE—Connect	Bioengineering	149999
PHD-BION: Bioengineering, PhD	Bioengineering	149999
PHD-BION-A: Bioengineering, PhD—Advanced Entry	Bioengineering	149999
BSBIOE-BEBC: Bioengineering and Biochemistry, BSBioE	Bioengineering/Biochemistry	149999
CERTG-BINF: Bioinformatics, Graduate Certificate	Bioinformatics	261103
MS-BINF: Bioinformatics, MS	Bioinformatics	261103
P-BS-BIOS: Biological Science, BS	Biological Science	260101
BS-BIOL: Biology, BS	Biology	260101
MS-BIOL: Biology, MS	Biology	260101
PHD-BIOL: Biology, PhD	Biology	260101
PHD-BIOL-A: Biology, PhD—Advanced Entry	Biology	260101

BS-BENG: Biology and English, BS	Biology/English	269999
BS-BIMA: Biology and Mathematics, BS	Biology/Mathematics	260101
BS-BIPO: Biology and Political Science, BS	Biology/Political Science	269999
BS-BIMP: Biomedical Physics, BS	Biomedical Physics	260203
MS-BIOM: Biomedical Science, MS	Biomedical Science	260102
PHD-BIOM: Biomedical Science, PhD	Biomedical Science	260102
PHD-BIOM-A: Biomedical Science, PhD—Advanced Entry	Biomedical Science	260102
CERTG-BIAS: Biopharmaceutical Analytical Sciences, Graduate Certificate	Biopharm Analytical Sci	400599
P-CERTG-BPRA: Biopharmaceutical Regulatory Affairs, Graduate Certificate	Biopharmaceutical Reg Affairs	512099
P-CERTG-BPQI: International Biopharmaceutical Regulatory Affairs, Graduate Certificate	Biopharmacy Quality Intl	512099
PHD-BPHY: Biophysics, PhD	Biophysics	260203
CERTG-BIOT: Biotechnology, Graduate Certificate	Biotechnology	261201
MS-BIOT-SC: Biotechnology, MS	Biotechnology	261201
P-BS-BIOT: Biotechnology, BS	Biotechnology	261201
CERTG-BITE: Biotechnology Enterprise, Graduate Certificate	Biotechnology Enterprise	261201
CERTG-RESC: Biotechnology Regulatory Science, Graduate Certificate	Biotechnology Regulatory Sci	512004
CERTG-BLCE: Blockchain and Smart Contract Engineering, Graduate Certificate	Blockchain Smart Contr. Engr	140903
CERTG-BMGT: Brand Management, Graduate Certificate	Brand Management	521401
CERTG-TBWS: Broadband Wireless Systems, Graduate Certificate	Broadband Wireless Systems	110901
BS-BALW: Business Administration and Law, BS	Business Admin and Law	520101
BS-BACS: Business Administration and Communication Studies, BS	Business Admin/Comm Studies	520101
BS-BACJ: Business Administration and Criminal Justice, BS	Business Admin/Crim Justice	520101
BS-BAPS: Business Administration and Psychology, BS	Business Admin/Psychology	520101
BS-BAPH: Business Administration and Public Health, BS	Business Admin/Public Health	520101
BSBA-BSAD: Business Administration, BSBA	Business Administration	520101
CERTG-BSAD: Business Administration, Graduate Certificate	Business Administration	520101
CERTG-BSAD-O: Business Administration—Online Program, Graduate Certificate	Business Administration	520101
MBA-BSAD-E: Business Administration, MBA—Part-Time	Business Administration	520101
MBA-BSAD-F: Business Administration, MBA—Full-Time	Business Administration	520101
MBA-BSAD2-O: Business Administration, MBA—Online	Business Administration	520101
BS-BUDE: Business Administration and Design, BS	Business Administration/Design	520101
CERTG-BUSA: Business Analytics, Graduate Certificate	Business Analytics	521302
MS-BUSA: Business Analytics, MS	Business Analytics	521302
MS-BUSA-O: Business Analytics, MS—Online	Business Analytics	521302
CERTG-BLAW: Business Law, Graduate Certificate	Business Law	220205
CERTG-HECA: Business Management for Healthcare, Graduate Certificate	Business Mgmt for Healthcare	521099

CERTG-CNSC: Cannabis Science, Graduate Certificate	Cannabis Science	513399
MS-CGTH: Cell and Gene Therapies, MS	Cell and Gene Therapies	260806
BS-CMBI: Cell and Molecular Biology, BS	Cell and Molecular Biology	260406
BSCHE-CEBE: Chemical Engineering and Bioengineering, BSChE	Chem Engineer/Bioengineering	140701
BSCHE-CHOC: Chemical Engineering and Biochemistry, BSChE	Chem Engineering/Biochemistry	140701
BSCHE-CHME: Chemical Engineering, BSChE	Chemical Engineering	140701
MSCHE-CHME: Chemical Engineering, MSChE	Chemical Engineering	140701
PHD-CHME: Chemical Engineering, PhD	Chemical Engineering	140701
PHD-CHME-A: Chemical Engineering, PhD—Advanced Entry	Chemical Engineering	140701
BSCHE-CHCS: Chemical Engineering and Computer Science, BSChE	Chemical Engineering/Comp Sci	140701
BSCHE-CEDS: Chemical Engineering and Data Science, BSChE	Chemical Engineering/Data Sci	140701
BSCHE-CEPH: Chemical Engineering and Physics, Chemical Engineering/Physics BSChE	Chemical Engineering/Physics	140701
BSCHE-CEEE: Chemical Engineering and Environmental Engineering, BSChE	Chemical Engr/Environ Engr	140701
BS-CHEM: Chemistry, BS	Chemistry	400501
MS-CHEM: Chemistry, MS	Chemistry	400501
PHD-CHEM: Chemistry, PhD	Chemistry	400501
PHD-CHEM-A: Chemistry, PhD—Advanced Entry	Chemistry	400501
PHD-CEEN: Civil and Environmental Engineering, PhD	Civil Environmental Engineer	140801
PHD-CEEN-A: Civil and Environmental Engineering, PhD—Advanced Entry	Civil Environmental Engineer	140801
BSCE-CEAS: Civil Engineering and Architectural Studies, BSCE	Civil Eng/Arch Studies	140801
BSCE-CIVE: Civil Engineering, BSCE	Civil Engineering	140801
MSCIVE-CIVE: Civil Engineering, MSCivE	Civil Engineering	140801
BSCE-CVCS: Civil Engineering and Computer Science, BSCE	Civil Engineering/Computer Sci	140801
CERTG-CLEN: Climate and Engineering, Graduate Certificate	Climate and Engineering	141401
MS-CLSE: Climate Science and Engineering, MS	Climate Sci and Engineering	141401
P-CERTG-CCAM: Cloud Computing Application and Management, Graduate Certificate	Cloud Computing App and Mgmt	110104
P-CERTG-CATH: Collegiate Athletics Administration, Graduate Certificate	Collegiate Athletics Admin	310504
BS-CMSL: Communication Studies and Speech-Language Pathology and Audiology	Comm Stud/Speech-Lang Path Aud	090101
BA-CMSO: Communication Studies and Sociology, BA	Comm Studies/Sociology	090199
BA-CMTH: Communication Studies and Theatre, BA	Comm Studies/Theatre	090199
P-MS-COED: Commerce and Economic Development, MS	Commerce and Economic Dvlpmnt	450603
BA-CMME: Communication and Media Studies, BA	Communication Media Studies	090199
BA-CMST: Communication Studies, BA	Communication Studies	090101
BS-CMDE: Communication Studies and Design, BS	Communication Studies/Design	090101
BS-CSBA: Computer Science and Business Administration, BS	Comp Sci/Business Admin	110101

BS-CSCP: Computer Science and Cognitive Psychology, BS	Comp Sci/Cognitive Psyc	110101
BS-CSES: Computer Science and Environmental and Sustainability Sciences, BS	Comp Sci/Environ and Sust Sci	110101
BS-CSMA: Computer Science and Mathematics, BS	Comp Sci/Mathematics	110101
BS-CSPP: Computer Science and Politics, Philosophy, and Economics, BS	Comp Sci/Politics, Phil Econ	110101
BS-CSSL: Computer Science and Speech-Language Pathology and Audiology, BS	Comp Sci/Speech-Lng Pth Aud	110101
MS-CNAN: Complex Network Analysis, MS	Complex Network Analysis	300601
CERTG-COSS: Computational Social Science, Graduate Certificate	Computational Social Science	305202
BSCMPE-CMPE: Computer Engineering, BSCmpE	Computer Engineering	140901
PHD-CMPE: Computer Engineering, PhD	Computer Engineering	140901
PHD-CMPE-A: Computer Engineering, PhD—Advanced Entry	Computer Engineering	140901
BSCMPE-CMPH: Computer Engineering and Physics, BSCmpE	Computer Engineering/Physics	140901
BSCMPE-CECS: Computer Engineering and Computer Science, BSCmpE	Computer Engr/Computer Science	140901
BS-CSBN: Computer Science and Behavioral Neuroscience, BS	Computer Sci/Behavior Neurosci	110101
BS-CSCS: Computer Science and Communication Studies, BS	Computer Sci/Communication Stu	110101
BS-CSCJ: Computer Science and Criminal Justice, BS	Computer Sci/Criminal Justice	110101
BS-CGDV: Computer Science and Game Development, BS	Computer Sci/Game Development	110101
BS-CSHL: Computer Science and Health Science, BS	Computer Sci/Health Sci	110101
BS-CSMU: Computer Science and Music, BS	Computer Sci/Music	110101
BS-CSMU-MUTE: Computer Science and Music with Concentration in Music Technology, BS	Computer Sci/Music	110101
BS-CSPL: Computer Science and Philosophy, BS	Computer Sci/Philosophy	110101
BS-CSPY: Computer Science and Physics, BS	Computer Sci/Physics	110101
BS-CSPO: Computer Science and Political Science, BS	Computer Sci/Political Sci	110101
BS-CSSO: Computer Science and Sociology, BS	Computer Sci/Sociology	110101
BACS-CSCI: Computer Science, BACS	Computer Science	110101
BSCS-CSCI: Computer Science, BSCS	Computer Science	110101
CERTG-CSCI: Computer Science, Graduate Certificate	Computer Science	110101
MSCS-CSCI: Computer Science, MSCS	Computer Science	110101
MSCS-CSCI-AL: Computer Science, MSCS—Align	Computer Science	110101
PHD-CSCI: Computer Science, PhD	Computer Science	110101
PHD-CSCI-A: Computer Science, PhD—Advanced Entry	Computer Science	110101
BS-CSBI: Computer Science and Biology, BS	Computer Science/Biology	110101
BS-CSDE: Computer Science and Design, BS	Computer Science/Design	110101
BS-CSEC: Computer Science and Economics, BS	Computer Science/Economics	110101
BS-CSEG: Computer Science and English, BS	Computer Science/English	110101
BS-CSHI: Computer Science and History, BS	Computer Science/History	110101
BS-CSJO: Computer Science and Journalism, BS	Computer Science/Journalism	110101
BS-CSLI: Computer Science and Linguistics, BS	Computer Science/Linguistics	110101
BS-CSME: Computer Science and Media Arts, BS	Computer Science/Media Arts	110101

BS-CSPH: Computer Science and Public Health, BS	Computer Science/Public Health	110101
BS-CSTH: Computer Science and Theatre, BS	Computer Science/Theatre	110101
BS-CPLW: Computing and Law, BS	Computing and Law	110101
P-CERTG-CONM: Construction Management, Graduate Certificate	Construction Management	460412
P-MS-CORC: Corporate and Organizational Communication, MS	Corporate Org Communication	090101
CERTG-COFN: Corporate Finance, Graduate Certificate	Corporate Finance	520801
CERTG-COIN: Corporate Innovation, Graduate Certificate	Corporate Innovation	520210
CERTG-CPRN: Corporate Renewal, Graduate Certificate	Corporate Renewal	520799
MSCP-COPS: Counseling Psychology, MSCP	Counseling Psychology	422803
PHD-COPS-MSE: Counseling Psychology, PhD	Counseling Psychology	422803
MS-CCMD: Creative Collaboration and Multidisciplinary Design, MS	Creatv Collab Multidisc Dsgn	501099
CERTG-CRAM: Crime Analysis and Mapping, Graduate Certificate	Crime Analysis and Mapping	430408
BS-CRJO: Criminal Justice and Journalism, BS	Criminal Justice/Journalism	430104
BS-CJPH: Criminal Justice and Philosophy, BS	Criminal Justice/Philosophy	430104
BS-CRPO: Criminal Justice and Political Science, BS	Criminal Justice/Political Sci	430104
BS-CJPS: Criminal Justice and Psychology, BS	Criminal Justice/Psychology	430199
BS-CJPB: Criminal Justice and Public Health, BS	Criminal Justice/Public Health	430104
BS-CRSO: Criminal Justice and Sociology, BS	Criminal Justice/Sociology	430104
BS-CRCJ: Criminology and Criminal Justice, BS	Criminology Criminal Justice	430104
MS-CRCJ: Criminology and Criminal Justice, MS	Criminology Criminal Justice	430104
PHD-CRJP: Criminology and Justice Policy, PhD	Criminology and Justice Policy	430104
PHD-CRJP-A: Criminology and Justice Policy, PhD—Advanced Entry	Criminology and Justice Policy	430104
P-CERTG-CCCM: Cross-Cultural Communication, Graduate Certificate	Cross-Cultural Communication	090100
MS-CDSC: Cross-Disciplinary Science, MS	Cross-Disciplinary Science	300101
BA-CAPH: Cultural Anthropology and Philosophy, BA	Cultural Anthro/Philosophy	450204
BA-CARS: Cultural Anthropology and Religious Studies, BA	Cultural Anthro/Religious Stud	450204
BA-CUAN: Cultural Anthropology, BA	Cultural Anthropology	451101
BS-CUAN: Cultural Anthropology, BS	Cultural Anthropology	451101
BA-CUTH: Cultural Anthropology and Theatre, BA	Cultural Anthropology/Theatre	451101
CERTG-CUEN: Cultural Entrepreneurship, Graduate Certificate	Cultural Entrepreneurship	501099
MS-CYPS: Cyber-Physical Systems, MS	Cyber-Physical Systems	140903
BS-CYBS: Cybersecurity, BS	Cybersecurity	111003
CERTG-CYBS: Cybersecurity, Graduate Certificate	Cybersecurity	111003
MS-CYBS: Cybersecurity, MS	Cybersecurity	111003
MS-CYBS-AL: Cybersecurity, MS—Align	Cybersecurity	111003
PHD-CYBS: Cybersecurity, PhD	Cybersecurity	111003
PHD-CYBS-A: Cybersecurity, PhD—Advanced Entry	Cybersecurity	111003
BS-CYBB: Cybersecurity and Business Administration, BS	Cybersecurity/Business Admin	111003
BS-CYCJ: Cybersecurity and Criminal Justice, BS	Cybersecurity/Criminal Justice	111003
BS-CYEC: Cybersecurity and Economics, BS	Cybersecurity/Economics	111003

CERTG-DAAN: Data Analytics, Graduate Certificate	Data Analytics	110802
CERTG-DAAE: Data Analytics Engineering, Graduate Certificate	Data Analytics Engineering	149999
CERTG-DAAE-O: Data Analytics Engineering, Graduate Certificate—Online	Data Analytics Engineering	149999
MS-DAAE: Data Analytics Engineering, MS	Data Analytics Engineering	149999
MS-DAAE-O: Data Analytics Engineering, MS—Online	Data Analytics Engineering	149999
MS-DAMG: Data Architecture and Management, MS	Data Architecture Management	110802
BS-DSEE: Data Science and Ecology and Evolutionary Biology, BS	Data Sci/Ecology Evol Bio	110802
BS-DSES: Data Science and Environmental and Sustainability Sciences, BS	Data Sci/Environ and Sust Sci	110802
BS-DSSL: Data Science and Speech-Language Pathology and Audiology, BS	Data Sci/Speech-Lng Pth Aud	110802
BS-DASC: Data Science, BS	Data Science	110802
MS-DASC: Data Science, MS	Data Science	110802
MS-DASC-AL: Data Science, MS—Align	Data Science	110802
BS-DSBN: Data Science and Behavioral Neuroscience, BS	Data Science/Behavioral Neuro	110802
BS-DSBC: Data Science and Biochemistry, BS	Data Science/Biochemistry	110802
BS-DSBL: Data Science and Biology, BS	Data Science/Biology	110802
BS-DSBA: Data Science and Business Administration, BS	Data Science/Business Admin	110802
BS-DSCH: Data Science and Chemistry, BS	Data Science/Chemistry	110802
BS-DSCM: Data Science and Communication Studies, BS	Data Science/Comm Studies	110802
BS-DSCJ: Data Science and Criminal Justice, BS	Data Science/Criminal Justice	110802
BS-DSDE: Data Science and Design, BS	Data Science/Design	110802
BS-DSEC: Data Science and Economics, BS	Data Science/Economics	110802
BS-DSHS: Data Science and Health Science, BS	Data Science/Health Science	110802
BS-DSIA: Data Science and International Affairs, BS	Data Science/Intl Affairs	110802
BS-DSJO: Data Science and Journalism, BS	Data Science/Journalism	110802
BS-DSL: Data Science and Linguistics, BS	Data Science/Linguistics	110802
BS-DSMA: Data Science and Mathematics, BS	Data Science/Mathematics	110802
BS-DSPL: Data Science and Philosophy, BS	Data Science/Philosophy	110802
BS-DSPH: Data Science and Physics, BS	Data Science/Physics	110802
BS-DSPS: Data Science and Psychology, BS	Data Science/Psychology	110802
BS-DSPB: Data Science and Public Health, BS	Data Science/Public Health	110802
BS-DSSO: Data Science and Sociology, BS	Data Science/Sociology	110802
BFA-DESN: Design, BFA	Design	500409
BS-DEMA: Design and Mathematics, BS	Design/Mathematics	500409
BS-DEPH: Design and Public Health, BS	Design/Public Health	500409
BS-DETH: Design and Theatre, BS	Design/Theatre	500409
CERTG-DPSI: Digital Platforms for Service Innovation, Graduate Certificate	Dgtl Pltfrms for Service Innov	110899
P-BS-DIME: Digital Communication and Media, BS	Digital Communication Media	090702
CERTG-DHUM: Digital Humanities, Graduate Certificate	Digital Humanities	240103
P-MPS-DGM-AL: Digital Media, MPS—Connect	Digital Media	090702
P-MPS-DGME: Digital Media, MPS	Digital Media	090702

P-CERTG-DGMM: Digital Media Management, Graduate Certificate	Digital Media Management	100105
P-CERTG-DVVD: Digital Video, Graduate Certificate	Digital Video	500602
MA-ECED: Early Childhood Education, MA	Early Childhood Education	131210
CERTG-EINT: Early Intervention, Graduate Certificate	Early Intervention	131099
BS-EEBI: Ecology and Evolutionary Biology, BS	Ecology Evolutionary Biology	261310
BA-ECON: Economics, BA	Economics	450603
BS-ECON: Economics, BS	Economics	450603
MS-ECON: Economics, MS	Economics	450603
PHD-ECON: Economics, PhD	Economics	450603
PHD-ECON-A: Economics, PhD—Advanced Entry	Economics	450603
BS-ECBA: Economics and Business Administration, BS	Economics/Business Admin	450603
BS-ECCJ: Economics and Criminal Justice, BS	Economics/Criminal Justice	450603
BS-ECHS: Economics and Human Services, BS	Economics/Human Services	450603
BS-ECIB: Economics and International Business, BS	Economics/Intl Business	450603
BS-ECJO: Economics and Journalism, BS	Economics/Journalism	450603
BS-ECMA: Economics and Mathematics, BS	Economics/Mathematics	450603
BS-ECPH: Economics and Philosophy, BS	Economics/Philosophy	450603
BS-ECPS: Economics and Psychology, BS	Economics/Psychology	450603
P-EDD-EDUC: Education, EdD	Education	130101
P-MED-EDUC: Education, MEd	Education	130101
P-CAGS-EDLM: Education Leadership Management, CAGS	Education Leadership Mgmt	130401
MA-EDLD: Educational Leadership, MA	Educational Leadership	130401
MSECEL-ECEL: Electrical and Computer Engineering Leadership, MSECEL	Elec and Comp Engr Leadership	141001
BSCMPE-ELCE: Electrical and Computer Engineering, BSCmpE	Electrical and Computer Engr	141001
BSEE-ELCE: Electrical and Computer Engineering, BSEE	Electrical and Computer Engr	141001
BSEE-ELEE: Electrical Engineering, BSEE	Electrical Engineering	141001
MSECE-ELEE: Electrical and Computer Engineering, MSECE	Electrical Engineering	141001
PHD-ELEE: Electrical Engineering, PhD	Electrical Engineering	141001
PHD-ELEE-A: Electrical Engineering, PhD—Advanced Entry	Electrical Engineering	141001
BSEE-EEMU: Electrical Engineering and Music with Concentration in Music Technology, BSEE	Electrical Engineering/Music	141001
BSEE-EEPH: Electrical Engineering and Physics, BSEE	Electrical Engineering/Physics	141001
P-MAT-ELED: Elementary Education, MAT	Elementary Education	131202
CERTG-ENES: Energy Systems, Graduate Certificate	Energy Systems	142701
MSENES-AL: Energy Systems, MSEnS—Academic Link	Energy Systems	142701
MSENES-ENES: Energy Systems, MSEnS	Energy Systems	142701
CERTG-ENSY: Energy Systems Management, Graduate Certificate	Energy Systems Management	142701
MS-CEPP: Engineering and Public Policy, MS	Engineering and Public Policy	140899
CERTG-ENBU: Engineering Business, Graduate Certificate	Engineering Business	140101

CERTG-EEDM: Engineering Economic Decision Making, Graduate Certificate	Engineering Economic Decision	140101
CERTG-ENLR: Engineering Leadership, Graduate Certificate	Engineering Leadership	141001
CERTG-ENGM: Engineering Management, Graduate Certificate	Engineering Management	140101
MSEM-ENGM: Engineering Management, MSEM	Engineering Management	140101
MSEM-ENGM-O: Engineering Management, MSEM—Online	Engineering Management	140101
CERTG-ETSM: Technology Systems Management, Graduate Certificate	Engineering Tech Systems Mgmt	140101
BA-ENGL: English, BA	English	230101
MA-ENGL: English, MA	English	230101
PHD-ENGL: English, PhD	English	230101
PHD-ENGL-A: English, PhD—Advanced Entry	English	230101
BA-ENCO: English and Communication Studies, BA	English/Communication Studies	230101
BA-ENCJ: English and Criminal Justice, BA	English/Criminal Justice	230101
BA-ENCA: English and Cultural Anthropology, BA	English/Cultural Anthropology	230101
BA-ENDE: English and Design, BA	English/Design	230101
BA-EPHI: English and Philosophy, BA	English/Philosophy	230101
BA-ENPS: English and Political Science, BA	English/Political Science	230101
BA-ENTH: English and Theatre, BA	English/Theatre	230101
CERTG-ENTR: Entrepreneurship, Graduate Certificate	Entrepreneurship	520701
BS-ESJO: Environmental and Sustainability Sciences and Journalism, BS	Environ Sust Sci/Journalism	030104
BS-ESCH: Environmental and Sustainability Sciences and Chemistry, BS	Environ and Sust Sci/Chemistry	030104
BS-ESEC: Environmental and Sustainability Sciences and Economics, BS	Environ and Sust Sci/Economics	030104
BS-ESLA: Environmental and Sustainability Sciences and Landscape Architecture, BS	Environ and Sust Sci/Land Arch	030104
BSENV-EECH: Environmental Engineering and Chemical Engineering, BSEnvE	Environ Engr/Chemical Engr	140801
BSENV-ENVI: Environmental Engineering, BSEnvE	Environmental Engineering	140801
MSENV-ENVI: Environmental Engineering, MSEnvE	Environmental Engineering	140801
BSENV-EEDS: Environmental Engineering and Data Science, BSEnvE	Environmental Engr/Data Sci	140801
BSENV-ENHS: Environmental Engineering and Health Science, BSEnvE	Environmental Engr/Health Sci	140801
MS-ENPP: Environmental Science and Policy, MS	Environmental Science Policy	030103
BA-ENVS: Environmental Studies, BA	Environmental Studies	030103
BS-ENSS: Environmental and Sustainability Sciences, BS	Environmtl Sustain Sciences	030104
BSENV-EELA: Environmental Engineering and Landscape Architecture, BSEnvE	Environmtl Engr/Landscape Arch	140801
BA-ENHI: Environmental Studies and History, BA	Environmtl Studies/Histroy	030103
BA-ENIA: Environmental Studies and International Affairs, BA	Environmtl Studies/Intl Affair	030103
BA-ENPH: Environmental Studies and Philosophy, Environmtl Studies/Philosophy BA	Environmtl Studies/Philosophy	030103
BA-ENPO: Environmental Studies and Political Science, BA	Environmtl Studies/Politic Sci	030103
P-CERTG-ESPT: eSports, Graduate Certificate	eSports	310504

CERTG-EXPD: Experience Design, Graduate Certificate	Experience Design	110105
MFA-EXPD: Experience Design, MFA	Experience Design	110105
MS-EXPD: Experience Design, MS	Experience Design	110105
CERTG-EPHD: Experiential PhD Leadership, Graduate Certificate	Experiential PhD Leadership	520210
P-CERTG-EXTL: Experiential Teaching and Learning, Graduate Certificate	Experiential Teach and Learn	130301
CERTG-EBIO: Experimental Biotechnology, Graduate Certificate	Experimental Biotechnology	261201
MS-EXRL: Extended Realities, MS	Extended Realities	110105
CERTG-EXMD: Extreme Medicine, Graduate Certificate	Extreme Medicine	519999
MSF-FINA: Finance, MSF	Finance	520801
P-BS-FIAM: Finance and Accounting Management, BS	Finance and Accounting Mgmt	520801
P-CERTG-FIMI: Financial Markets and Institutions, Graduate Certificate	Financial Mkts and Inst	520899
MS-FTMG: Management, MS with Major in Fintech Management	Fintech Management	307104
P-CERTG-FACC: Forensic Accounting, Graduate Certificate	Forensic Accounting	430406
P-CERTG-FDDV: Fundraising and Development, Graduate Certificate	Fundraising and Development	520206
BFA-GAAN: Game Art and Animation, BFA	Game Art and Animation	500605
BFA-GAME: Game Design, BFA	Game Design	100304
P-CERTG-GMDS: Game Design, Graduate Certificate	Game Design	100304
BS-GDMT: Game Design and Music with Concentration in Music Technology, BS	Game Design/Music	100304
CERTG-GMED: Game Experience Design, Graduate Certificate	Game Experience Design	100304
CERTG-GMSC: Game Science, Graduate Certificate	Game Science	100304
MS-GSAD: Game Science and Design, MS	Game Science and Design	100304
P-CERTG-GINT: Geographic Information Systems, Graduate Certificate	Geographic Information Tech	110103
BA-GLAS: Global Asian Studies, BA	Global Asian Studies	050103
CERTG-GLDR: Global Doctoral Research, Graduate Certificate	Global Doctoral Research	302001
P-CERTG-GSIR: Global Studies and International Relations, Graduate Certificate	Global Stu and Intl Relations	302001
P-MS-GSIR: Global Studies and International Relations, MS	Global Stu and Intl Relations	302001
MS-DAAH: Health Data Analytics, MS—Online	Health Data Analytics	512706
CERTG-HIME: Health Informatics Management and Exchange, Graduate Certificate	Health Info Mgmt Exchange	512706
MS-HEIN: Health Informatics, MS	Health Informatics	512706
MS-HEIN-O: Health Informatics, MS	Health Informatics	512706
CERTG-HLAW: Health Law, Graduate Certificate	Health Law	220208
CERTG-HLAP: Health Law and Policy, Graduate Certificate	Health Law and Policy	220208
BS-HLCJ: Health Science and Criminal Justice, BS	Health Sci/Criminal Justice	510799
BS-HLSC: Health Science, BS	Health Science	510799
P-BS-HLSC: Health Science, BS	Health Science	510799
BS-HSLW: Health Science and Law, BS	Health Science and Law	440503

BS-HSBA: Health Science and Business Administration, BS	Health Science/Business Admin	510799
BS-HLCM: Health Science and Communication Studies, BS	Health Science/Comm Studies	510799
BS-HSPS: Health Science and Psychology, BS	Health Science/Psychology	510799
BS-HSSO: Health Science and Sociology, BS	Health Science/Sociology	510799
BS-HSSP: Health Science and Spanish, BS	Health Science/Spanish	510799
P-BS-HCAD: Healthcare Administration, BS	Healthcare Administration	510701
P-CERTU-HCAD: Healthcare Administration, Undergraduate Certificate	Healthcare Administration	510701
CERTG-CLAW: Healthcare Compliance, Graduate Certificate	Healthcare Compliance	220208
DMSC-HCLD: Healthcare Leadership, DMSc	Healthcare Leadership	510701
P-CERTG-HEDA: Higher Education Administration, Higher Education Admin Graduate Certificate		130406
P-MED-HEDA: Higher Education Administration, MEd	Higher Education Admin	130406
BA-HIST: History, BA	History	540101
BS-HIST: History, BS	History	540101
MA-HIST: History, MA	History	540101
PHD-HIST: History, PhD	History	540101
PHD-HIST-A: History, PhD—Advanced Entry	History	540101
BA-HICL: History, Culture, and Law, BA	History, Culture, and Law	220000
BA-HIAS: History and Asian Studies, BA	History/Asian Studies	540101
BA-HICJ: History and Criminal Justice, BA	History/Criminal Justice	540101
BA-HICA: History and Cultural Anthropology, BA	History/Cultural Anthropol	540101
BA-HIEC: History and Economics, BA	History/Economics	540101
BS-HIEC: History and Economics, BS	History/Economics	540101
BA-HIEN: History and English, BA	History/English	540101
BA-HIPH: History and Philosophy, BA	History/Philosophy	540101
BA-HIPS: History and Political Science, BA	History/Political Science	540101
BA-HIRS: History and Religious Studies, BA	History/Religious Studies	540101
BS-HHHS: Health Humanities and Health Science, BS	Hlth Humanities/Hlth Science	513204
BA-HHHPH: Health Humanities and Public Health, BA	Hlth Humanities/Public Hlth	513204
PHD-HBSS: Human Behavior and Sustainability Sciences, PhD	Human Behavior and Sustain Sci	300601
MS-HUFA: Human Factors, MS	Human Factors	142701
MS-HMRS: Human Movement and Rehabilitation Sciences, MS	Human Movement Rehab Science	512314
PHD-HMRS: Human Movement and Rehabilitation Sciences, PhD	Human Movement Rehab Science	512314
PHD-HMRS-A: Human Movement and Rehabilitation Sciences, PhD—Advanced Entry	Human Movement Rehab Science	512314
CERTG-HURL: Human Resources Law, Graduate Certificate	Human Resources Law	220299
P-CERTG-HRMG: Human Resources Management, Graduate Certificate	Human Resources Management	521001
P-MS-HRMG: Human Resources Management, MS	Human Resources Management	521001
CERTG-HMRL: Human Rights Law, Graduate Certificate	Human Rights Law	220209
BA-HSVC: Human Services, BA	Human Services	440000
BS-HSVC: Human Services, BS	Human Services	440000

BA-HSCM: Human Services and Communication Studies, BA	Human Services/Comm Studies	440000
BS-HSCJ: Human Services and Criminal Justice, BS	Human Services/Crim Justice	430199
BA-HSIA: Human Services and International Affairs, BA	Human Services/Intl Affairs	440000
BS-HUPS: Human Services and Psychology, BS	Human Services/Psychology	440000
BA-HSPH: Human Services and Public Health, BA	Human Services/Public Health	440000
BA-HUSO: Human Services and Sociology, BA	Human Services/Sociology	449999
BS-HUSO: Human Services and Sociology, BS	Human Services/Sociology	449999
P-CERTG-HUIN: Human-Centered Informatics, Graduate Certificate	Human-Centered Informatics	110104
CERTG-ICSE: Inclusive Computer Science Education, Graduate Certificate	Inclusive Computer Sci Educ	131321
BSIE-INDE: Industrial Engineering, BSIE	Industrial Engineering	143501
MSIE-INDE: Industrial Engineering, MSIE	Industrial Engineering	143501
PHD-INDE: Industrial Engineering, PhD	Industrial Engineering	143501
PHD-INDE-A: Industrial Engineering, PhD—Advanced Entry	Industrial Engineering	143501
BSIE-IEBA: Industrial Engineering and Business Administration, BSIE	Industrial Engr/Business Admin	143501
BSIE-IECS: Industrial Engineering and Computer Science, BSIE	Industrial Engr/Computer Sci	143501
CERTG-IDEV: Information Design and Visualization, Graduate Certificate	Info Design and Visualization	500401
MFA-IDDV: Information Design and Data Visualization, MFA	Info Dsgn Data Visualization	303101
MS-IDDV: Information Design and Data Visualization, MS	Info Dsgn Data Visualization	303101
P-CERTG-INSM: Information Security Management, Graduate Certificate	Info Security Management	439999
P-MPS-INFN: Informatics, MPS	Informatics	110104
CERTG-INET: Information Ethics, Graduate Certificate	Information Ethics	380104
MSIS-INSY: Information Systems, MSIS	Information Systems	140903
MSIS-INSY-B: Information Systems, MSIS—Bridge	Information Systems	140903
MSIS-INSY-O: Information Systems, MSIS—Online	Information Systems	140903
MSIS-IS-B-O: Information Systems, MSIS—Bridge Online	Information Systems	140903
P-BS-INFN: Information Technology, BS	Information Technology	110103
P-CERTG-IAMG: Insurance Analytics and Management, Graduate Certificate	Insurance Analytics and Mgmt	521701
P-MPS-IAMG: Insurance Analytics and Management, MPS	Insurance Analytics and Mgmt	521701
CERTG-PLAW: Intellectual Property Law, Graduate Certificate	Intellectual Property Law	220212
P-CERTG-INDS: Interactive Design, Graduate Certificate	Interactive Design	110801
PHD-INTY: Interdisciplinary, PhD	Interdisciplinary	300000
PHD-INTY-A: Interdisciplinary, PhD—Advanced Entry	Interdisciplinary	300000
PHD-IDSM: Interdisciplinary Design and Media, PhD	Interdisciplinary Dsgn Media	500401
PHD-IDSM-A: Interdisciplinary Design and Media, PhD—Advanced Entry	Interdisciplinary Dsgn Media	500401
PHD-INTE: Interdisciplinary Engineering, PhD	Interdisciplinary Engineering	140101

PHD-INTE-A: Interdisciplinary Engineering, PhD— Advanced Entry	Interdisciplinary Engineering	140101
BS-INST: Interdisciplinary Studies, BS	Interdisciplinary Studies	240101
P-BS-INST: Interdisciplinary Studies, BS	Interdisciplinary Studies	240101
BA-INAF: International Affairs with African Studies Concentration, BA	International Affairs	450901
MA-INAF: International Affairs, MA	International Affairs	450901
BA-IAHI: International Affairs and History, BA	International Affairs/History	450901
BSIB-INBU-NX: International Business, BSIB	International Business	521101
BSIB-INBU-X: International Business, BSIB	International Business	521101
CERTG-INBU: International Business, Graduate Certificate	International Business	521101
MS-INMA: International Management, MS	International Management	520101
MS-INOT: Internet of Things, MS	Internet of Things	140999
BA-IARS: International Affairs and Religious Studies, BA	Intl Affairs/Religious Stu	450901
BA-IACJ: International Affairs and Criminal Justice, BA	Intl Affairs/Criminal Justice	450901
BA-IACA: International Affairs and Cultural Anthropology, BA	Intl Affairs/Cultural Anthro	450901
BA-IAEC: International Affairs and Economics, BA	Intl Affairs/Economics	450604
BS-IAIB: International Affairs and International Business, BS	Intl Affairs/Intl Business	450901
CERTG-INVS: Investments, Graduate Certificate	Investments	520807
CERTG-TIPS: IP Telephony Systems, Graduate Certificate	IP/Telephony Systems	110901
BA-JESR: Jewish Studies and Religion, BA	Jewish Studies/Religion	380206
BA-JOUR: Journalism, BA	Journalism	090401
MA-JOUR: Journalism, MA	Journalism	090401
BA-JOCM: Journalism and Communication Studies, BA	Journalism/Comm Studies	090401
BA-JOCA: Journalism and Cultural Anthropology, BA	Journalism/Cultural Anthro	090401
BS-JODE: Journalism and Design, BS	Journalism/Design	090401
BA-JOEN: Journalism and English, BA	Journalism/English	090401
BA-JOIA: Journalism and International Affairs, BA	Journalism/Intl Affairs	090401
BA-JOPO: Journalism and Political Science, BA	Journalism/Political Science	090401
BA-JOSO: Journalism and Sociology, BA	Journalism/Sociology	090401
BLA-LARC: Landscape Architecture, BLA	Landscape Architecture	040601
JD-LAW: Law, JD	Law	220101
JD-LAW-P: Law, JD—Part-Time Program	Law	220101
LLM-LAW: Law, LLM—Experiential	Law	220101
LLM-LAW-O: Law, LLM—Online	Law	220101
LLM-LAW-T: Law, LLM	Law	220101
P-DLP-LAPO: Law and Policy, DLP	Law and Policy	229999
P-CERTG-LEAD: Leadership, Graduate Certificate	Leadership	520213
CERTG-LEPO: Leading People and Organizations, Graduate Certificate	Leading People Organizations	521099
P-CERTG-PMTE: Leading and Managing Technical Projects, Graduate Certificate	Leadng Managng Tech Projects	520211
CERTG-LEAN: Lean Six Sigma, Graduate Certificate	Lean Six Sigma	140101
P-CERTG-LXDT: Learning Experience Design and Technology, Graduate Certificate	Learning Exp Design Tech	130501
P-MPS-LXDT: Learning Experience Design and Technology, MPS	Learning Exp Design Tech	130501

CERTG-LEDS: Legal Design, Graduate Certificate	Legal Design	220299
MLS-LEGS: Legal Studies, MLS—Online	Legal Studies	229999
BS-LING: Linguistics, BS	Linguistics	160102
BA-LICS: Linguistics and Communication Studies, Linguistics/Comm Studies	Linguistics/Comm Studies	160102
BA		
BS-LICA: Linguistics and Cultural Anthropology, BS	Linguistics/Cultural Anthro	450204
BA-LIEN: Linguistics and English, BA	Linguistics/English	160102
BS-LIPS: Linguistics and Psychology, BS	Linguistics/Psychology	160102
BS-LISL: Linguistics and Speech-Language Pathology and Audiology, BS	Linguistics/Speech-Lng Pth Aud	160102
MS-MGMT: Management, MS	Management	520201
P-BS-MGMT: Management, BS	Management	520201
CERTG-MQOB: Manufacturing and Quality Operations in Biotechnology, Graduate Certificate	Manuf Qual Oper in Biotech	512010
MS-MRES: Marine and Environmental Sciences, MS	Marine Environment Sciences	030104
PHD-MRES: Marine and Environmental Sciences, PhD	Marine Environment Sciences	030104
PHD-MRES-A: Marine and Environmental Sciences, PhD—Advanced Entry	Marine Environment Sciences	030104
BS-MARB: Marine Biology, BS	Marine Biology	261302
BS-MARB3: Marine Biology, BS with Three Seas	Marine Biology	261302
MS-MARB: Marine Biology, MS	Marine Biology	261302
CERTG-MKTG: Marketing, Graduate Certificate	Marketing	521401
CERTG-MKAN: Marketing Analytics, Graduate Certificate	Marketing Analytics	521402
BA-MATH: Mathematics, BA	Mathematics	270101
BS-MATH: Mathematics, BS	Mathematics	270101
MS-MATH: Mathematics, MS	Mathematics	270101
PHD-MATH: Mathematics, PhD	Mathematics	270101
PHD-MATH-A: Mathematics, PhD—Advanced Entry	Mathematics	270101
BS-MABA: Mathematics and Business Administration, BS	Mathematics/Business Admin	270101
BS-MAPL: Mathematics and Philosophy, BS	Mathematics/Philosophy	270101
BS-MAPH: Mathematics and Physics, BS	Mathematics/Physics	270101
BS-MAPO: Mathematics and Political Science, BS	Mathematics/Political Science	270101
BS-MAPY: Mathematics and Psychology, BS	Mathematics/Psychology	270101
BS-MASO: Mathematics and Sociology, BS	Mathematics/Sociology	270101
BSME-MECE: Mechanical Engineering, BSME	Mechanical Engineering	141901
MSME-MECE: Mechanical Engineering, MSME	Mechanical Engineering	141901
PHD-MECE: Mechanical Engineering, PhD	Mechanical Engineering	141901
PHD-MECE-A: Mechanical Engineering, PhD—Advanced Entry	Mechanical Engineering	141901
BSME-MEDS: Mechanical Engineering and Design, BSME	Mechanical Engineering/Design	141901
BSME-MEHI: Mechanical Engineering and History, BSME	Mechanical Engineering/History	141901
BSME-MEPH: Mechanical Engineering and Physics, BSME	Mechanical Engineering/Physics	141901
BSME-MEBE: Mechanical Engineering and Bioengineering, BSME	Mechanical Engr/Bioengineering	141901
BSME-MECS: Mechanical Engineering and Computer Science, BSME	Mechanical Engr/Computer Sci	141901
P-BS-MTRO: Mechatronics, BS	Mechatronics	144201

BA-MSPH: Media and Screen Studies and Philosophy, BA	Media Screen Stud/Philosophy	090199
BA-MSHI: Media and Screen Studies and History, BA	Media Screen Studies/History	090199
MS-MEDA: Media Advocacy, MS	Media Advocacy	099999
BA-MSST: Media and Screen Studies, BA	Media and Screen Studies	090199
BFA-MART: Media Arts, BFA	Media Arts	500102
BA-MACM: Media Arts and Communication Studies, BA	Media Arts/Comm Studies	500102
MS-MIDC: Media Innovation and Data Communication, MS	Media Innovation and Data Comm	090702
BA-MSJO: Media and Screen Studies and Journalism, BA	Media Screen Stu/Journalism	090199
BA-MSPO: Media and Screen Studies and Political Science, BA	Media Screen Stu/Political Sci	090199
BA-MSSO: Media and Screen Studies and Sociology, BA	Media Screen Stu/Sociology	090199
BA-MSTH: Media and Screen Studies and Theatre, BA	Media Screen Stu/Theatre	090199
BS-MSTH: Media and Screen Studies and Theatre, BS	Media Screen Stu/Theatre	090199
BA-MSMA: Media and Screen Studies and Media Arts, BA	Media Screen Stud./Media Arts	090199
BA-MSEN: Media and Screen Studies and English, BA	Media Screen Studies/English	090199
MS-MTET: Media, Technology, and Ethics, MS	Media, Technology, and Ethics	090702
P-CERTG-MDRA: Medical Device Regulatory Affairs, Graduate Certificate	Medical Device Regulatory Aff.	512799
CERTG-MSWE: Medical Software Engineering, Graduate Certificate	Medical Software Engineering	512706
MS-MCDD: Medicinal Chemistry Drug Discovery, MS	Medicinal Chem Drug Discov	512004
PHD-MCDD: Medicinal Chemistry and Drug Discovery, PhD	Medicinal Chem Drug Discov	512004
PHD-MCDD-A: Medicinal Chemistry and Drug Discovery, PhD—Advanced Entry	Medicinal Chem Drug Discov	512004
CERTG-MOBI: Molecular Biotechnology, Graduate Certificate	Molecular Biotechnology	261201
MA-MSED: Multiple Subject Education, MA	Multiple Subject Education	131202
BA-MUSI: Music, BA	Music	500901
BS-MUSI-MUID: Music with Concentration in Music Industry, BS	Music	500901
BS-MUSI-MUTE: Music with Concentration in Music Technology, BS	Music	500901
BS-MUBA: Music and Business Administration with Concentration in Music Industry, BS	Music/Business Administration	500901
BS-MUCM: Music and Communication Studies with Concentration in Music Industry, BS	Music/Communication Studies	500901
CERTG-MFMG: Mutual Fund Management, Graduate Certificate	Mutual Fund Management	520807
CERTG-NNMD: Nanomedicine, Graduate Certificate	Nanomedicine	300101
MS-NNMD: Nanomedicine, MS	Nanomedicine	300101
MS-NETS: Network Science, MS	Network Science	300601
PHD-NETS: Network Science, PhD	Network Science	300601
P-CERTG-NCBR: Nonclinical Biomedical Product Regulation, Graduate Certificate	Nonclinical Biomed Product Reg	512002

CERTG-NPSC: Nonprofit Sector, Philanthropy, and Social Change, Graduate Certificate	Nonprof-Philanth-Social Change	520206
P-CERTG-NPMG: Nonprofit Management, Graduate Certificate	Nonprofit Management	520206
P-MS-NPMG: Nonprofit Management, MS	Nonprofit Management	520206
DNP-NUAN: Nurse Anesthesia, DNP	Nurse Anesthesia	513804
BSN-NURS: Nursing, BSN	Nursing	513801
BSN-NURS-2: Nursing, BSN—Accelerated Program for Second-Degree Students	Nursing	513801
BSN-NURS-T: Nursing, BSN—Transfer Track	Nursing	513801
CAGS-CCAC: Nursing—Adult-Gerontology Nurse Practitioner, Acute Care, CAGS	Nursing	513801
CAGS-CCNN: Nursing—Neonatal Nurse Practitioner, CAGS	Nursing	513801
CAGS-PCAN: Nursing—Adult-Gerontology Nurse Practitioner, Primary Care, CAGS	Nursing	513801
CAGS-PEAC: Nursing—Pediatric Nurse Practitioner, Acute Care, CAGS	Nursing	513801
CAGS-PEPA: Nursing—Pediatric Nurse Practitioner, Acute and Primary Care, CAGS	Nursing	513801
CAGS-PEPC: Nursing—Pediatric Nurse Practitioner, Primary Care, CAGS	Nursing	513801
CAGS-PSMH: Nursing—Psychiatric-Mental Health Nursing Nurse Practitioner, CAGS		513801
DNP-NURS: Nursing, DNP—Post-Master's	Nursing	513801
DNP-NURS-BSE: Nursing, DNP	Nursing	513801
MS-NURS: Nursing, MS	Nursing	513801
MS-NURS-DE: Nursing, MS—Direct Entry	Nursing	513801
PHD-NURS: Nursing, PhD	Nursing	513801
PHD-NURS-MSE: Nursing, PhD—Advanced Entry	Nursing	513801
MS-NULD: Nursing Leadership, MS	Nursing Leadership	513802
CERTG-OMIC: Omics, Graduate Certificate	Omics	261103
MSOR-OPRE: Operations Research, MSOR	Operations Research	143701
MSOR-OPRE-AS: Operations Research, MSOR	Operations Research	143701
CERTG-ORCM-O: Organizational Communication, Graduate Certificate—Online	Organizational Communication	090901
P-CERTG-ORG: Organizational Communication, Graduate Certificate	Organizational Communication	090101
P-MS-ORLD: Organizational Leadership, MS	Organizational Leadership	520213
CERTG-PTSF: Patient Safety, Graduate Certificate	Patient Safety	512213
CERTG-PEAC: Pediatric Nurse Practitioner, Acute Care, Graduate Certificate	Pediatric Acute Care PNP	513814
BS-PFER: Performance and Extended Realities, BS	Performance and Ext Realities	100304
PHD-PHEI: Personal Health Informatics, PhD	Personal Health Informatics	512706
MS-PHEN: Pharmaceutical Engineering, MS	Pharmaceutical Engineering	140702
BS-PHSC: Pharmaceutical Sciences, BS	Pharmaceutical Sciences	512010
CERTG-PHT: Pharmaceutical Technologies, Graduate Certificate	Pharmaceutical Technologies	261201
MS-PHDD: Pharmaceutics and Drug Delivery, MS	Pharmaceutics Drug Delivery	512010
PHD-PHDD: Pharmaceutics and Drug Delivery, PhD	Pharmaceutics Drug Delivery	512010
PHD-PHDD-A: Pharmaceutics and Drug Delivery, PhD—Advanced Entry	Pharmaceutics Drug Delivery	512010
MS-PHAC: Pharmacology, MS	Pharmacology	261001
PHD-PHAC: Pharmacology, PhD	Pharmacology	261001

PHD-PHAC-A: Pharmacology, PhD—Advanced Entry	Pharmacology	261001
PHARMD-G: Pharmacy, PharmD	Pharmacy	512001
PHARMD-G-DE: Pharmacy, PharmD—Direct Entry	Pharmacy	512001
PHARMD-U: Pharmacy, PharmD	Pharmacy	512001
BS-PHST: Pharmacy Studies, BS	Pharmacy Studies	512001
BA-PHIL: Philosophy, BA	Philosophy	380101
BS-PHIL: Philosophy, BS	Philosophy	380101
DPT-PHTH-DE: Physical Therapy, DPT—Postbaccalaureate Entry	Physical Therapy	512308
MS-PHAS: Physician Assistant, MS	Physician Assistant	510912
BS-PHYS: Physics, BS	Physics	400801
MS-PHYS: Physics, MS	Physics	400801
PHD-PHYS: Physics, PhD	Physics	400801
PHD-PHYS-A: Physics, PhD—Advanced Entry	Physics	400801
BS-PHMU: Physics and Music with Concentration in Music Technology, BS	Physics/Music	400801
BS-PHPH: Physics and Philosophy, BS	Physics/Philosophy	400801
BA-POLI: Political Science, BA	Political Science	451001
BS-POLI: Political Science, BS	Political Science	451001
MA-POLI: Political Science, MA	Political Science	451001
PHD-POLI: Political Science, PhD	Political Science	451001
PHD-POLI-A: Political Science, PhD—Advanced Entry	Political Science	451001
BS-POBA: Political Science and Business Administration, BS	Political Science/Business Adm	451001
BA-POCM: Political Science and Communication Studies, BA	Political Science/Comm Studies	451001
BS-POCM: Political Science and Communication Studies, BS	Political Science/Comm Studies	451001
BA-POEC: Political Science and Economics, BA	Political Science/Economics	451001
BS-POEC: Political Science and Economics, BS	Political Science/Economics	450603
BA-POHS: Political Science and Human Services, BA	Political Science/HumanService	451001
BS-POHS: Political Science and Human Services, BS	Political Science/HumanService	451001
BA-POIA: Political Science and International Affairs, BA	Political Science/Intl Affairs	451001
BA-POPL: Political Science and Philosophy, BA	Political Science/Philosophy	451001
BS-POPL: Political Science and Philosophy, BS	Political Science/Philosophy	451001
BS-PPBA: Politics, Philosophy, and Economics and Business Administration, BS	Politics, Phil Econ/Bus Adm	451099
BS-PSPE: Politics, Philosophy, and Economics, BS	Politics, Philosophy, and Econ	451099
MS-POHE: Population Health, MS	Population Health	512299
PHD-POHE: Population Health, PhD	Population Health	512299
PHD-POHE-A: Population Health, PhD—Advanced Entry	Population Health	512299
CERTG-PSTE: Postsecondary Teaching, Graduate Certificate	Postsecondary Teaching	131214
CERTG-PLEJ: Poverty Law and Economic Justice, Graduate Certificate	Poverty Law Economic Justice	220299
P-CERTU-PMED: Premedical Studies, Postbaccalaureate Undergraduate Certificate	Pre-Medical Studies	511102
CERTG-PCFN: Primary Care Nursing FNP, Graduate Certificate	Primary Care Nursing FNP	513805

P-CERTU-PRMA: Principles of Manufacturing, Undergraduate Certificate	Principles of Manufacturing	150613
CERTG-PRVL: Privacy Law, Graduate Certificate	Privacy Law	220299
CERTG-PSEN: Process Safety Engineering, Graduate Certificate	Process Safety Engineering	140799
CERTG-PRSC: Process Science, Graduate Certificate	Process Science	261201
MS-PRDV: Product Development, MS	Product Development	142701
CERTG-PDMG: Product Management, Graduate Certificate	Product Management	111005
MSAMBA-PRAC: Accounting and Business Administration, MSAMBA	Professional Accounting	520301
P-CERTG-PSAD: Professional Sports Administration, Graduate Certificate	Professional Sports Admin	310504
DPS-PRST: Professional Studies, DPS	Professional Studies	459999
P-CERTG-PBUA: Project Business Analysis, Graduate Certificate	Project Business Analysis	521302
CERTG-PMGT-O: Project Management, Graduate Certificate—Online	Project Management	521301
P-BS-PMGT: Project Management, BS	Project Management	521301
P-CERTG-PMGT: Project Management, Graduate Certificate	Project Management	521301
P-CERTU-PMGT: Project Management, Undergraduate Certificate	Project Management	521301
P-MS-PMGT: Project Management, MS	Project Management	521301
BS-PSYC: Psychology, BS	Psychology	422799
MS-PSYC: Psychology, MS	Psychology	422799
P-BS-PSYC: Psychology, BS	Psychology	422799
PHD-PSYC: Psychology, PhD	Psychology	422799
PHD-PSYC-A: Psychology, PhD—Advanced Entry	Psychology	422799
BS-PSDE: Psychology and Design, BS	Psychology/Design	422799
BS-PSMU: Psychology and Music, BS	Psychology/Music	422799
BS-PSTH: Psychology and Theatre, BS	Psychology/Theatre	422799
MPA-PUAD: Public Administration, MPA	Public Administration	440401
P-CERTG-PUMR: Public and Media Relations, Graduate Certificate	Public and Media Relations	090102
BA-PUHE: Public Health, BA	Public Health	512201
MPH-PUHE: Public Health, MPH	Public Health	512201
MPH-PUHE-EX: Public Health, MPH—Accelerated	Public Health	512201
BA-PHLW: Public Health and Law, BA	Public Health and Law	440503
BA-PHCM: Public Health and Communication Studies, BA	Public Health/Comm Studies	512201
BA-PHCA: Public Health and Cultural Anthropology, BA	Public Health/Cultural Anthro	512201
BA-PHJO: Public Health and Journalism, BA	Public Health/Journalism	512201
BA-PHSO: Public Health and Sociology, BA	Public Health/Sociology	512201
CERTG-PUHI: Public History, Graduate Certificate	Public History	540105
MPP-PUPL: Public Policy, MPP	Public Policy	440401
PHD-PUPL: Public Policy, PhD	Public Policy	440401
PHD-PUPL-A: Public Policy, PhD—Advanced Entry	Public Policy	440401
CERTG-PUPA: Public Policy Analysis, Graduate Certificate	Public Policy Analysis	440501
BA-PUBR: Public Relations, BA	Public Relations	090902
P-CERTG-QASC: Quality Assurance Compliance, Graduate Certificate	Quality Assurance Compliance	510720
MSF-QFIN: Quantitative Finance, MSF	Quantitative Finance	270305

P-MS-REAF: Regulatory Affairs, MS	Regulatory Affairs	512009
BA-REST: Religious Studies, BA	Religious Studies	380201
BA-RSAS: Religious Studies and Africana Studies, Religious Studies/Africana St. BA	Religious Studies/Africana St.	380201
P-CERTG-RESE: Remote Sensing, Graduate Certificate	Remote Sensing	450799
CERTG-ERES: Renewable Energy, Graduate Certificate	Renewable Energy	142701
CERTG-RESS: Resilience Studies, Graduate Certificate	Resilience Studies	459999
MS-RESS: Resilience Studies, MS	Resilience Studies	459999
MS-ROBO: Robotics, MS	Robotics	144201
CAGS-SCPS: School Psychology, CAGS	School Psychology	422805
PHD-SCPS-BSE: School Psychology, PhD	School Psychology	422805
PHD-SCPS-MSE: School Psychology, PhD—Advanced Entry	School Psychology	422805
P-MAT-SCED: Secondary Education, MAT	Secondary Education	131205
P-MA-SCIS: Security and Intelligence Studies, MA	Security and Intelligence Stud	430399
MS-SCEN: Semiconductor Engineering, MS	Semiconductor Engineering	151601
MA-SSED: Single Subject Education, MA	Single Subject Education	131205
P-CERTG-SMOP: Social Media for Organizational Performance, Graduate Certificate	Social Media for Org Perform	090101
BA-SOCl: Sociology, BA	Sociology	451101
BS-SOCl: Sociology, BS	Sociology	451101
MA-SOCl: Sociology, MA	Sociology	451101
PHD-SOCl: Sociology, PhD	Sociology	451101
PHD-SOCl-A: Sociology, PhD—Advanced Entry	Sociology	451101
BA-SOCA: Sociology and Cultural Anthropology, BA	Sociology/Cultural Anthropol	451101
BS-SOCA: Sociology and Cultural Anthropology, BS	Sociology/Cultural Anthropol	451101
BA-SOES: Sociology and Environmental Studies, BA	Sociology/Envr. Studies	451101
BA-SOIA: Sociology and International Affairs, BA	Sociology/Intl Affairs	451101
BA-SOPH: Sociology and Philosophy, BA	Sociology/Philosophy	451101
BA-SOPO: Sociology and Political Science, BA	Sociology/Political Science	459999
BA-SORL: Sociology and Religious Studies, BA	Sociology/Religious Studies	451101
CERTG-SWES: Software Engineering Systems, Graduate Certificate	Software Engineering Systems	140903
MS-SWES: Software Engineering Systems, MS	Software Engineering Systems	140903
BA-SPAN: Spanish, BA	Spanish	160905
BA-SPIA: Spanish and International Affairs, BA	Spanish/International Affairs	160905
BA-SPLI: Spanish and Linguistics, BA	Spanish/Linguistics	160905
BA-SPPH: Spanish and Public Health, BA	Spanish/Public Health	160905
BS-SLPA: Speech-Language Pathology and Audiology, BS	Speech-Lang Pathol/Audiology	510204
MS-SLPT: Speech-Language Pathology, MS	Speech-Language Pathology	510204
MS-SLPT-C: Speech-Language Pathology, MS—Connect	Speech-Language Pathology	510204
BS-SLBN: Speech-Language Pathology and Audiology and Behavioral Neuroscience, BS	Speech-Lng Pth Aud/Behav Neuro	510204
BS-SLHS: Speech-Language Pathology and Audiology and Human Services, BS	Speech-Lng Pth Aud/Human Serv	510204
P-MSLD-SPLE: Sports Leadership, MSLD	Sports Leadership	310504
MS-STAT: Statistics, MS	Statistics	270501
MS-STAT-C: Statistics, MS—Connect	Statistics	270501

BFA-STAR: Studio Art, BFA	Studio Art	500702
CERTG-SCEM: Supply Chain Engineering Management, Graduate Certificate	Supply Chain Engineering Mgmt	140101
CERTG-SUPC: Supply Chain Management, Graduate Certificate	Supply Chain Management	520203
CERTG-SUCP: Sustainability and Climate Change Policy, Graduate Certificate	Sustain Climate Chnge Policy	440501
CERTG-SUBE: Sustainability and Business, Graduate Certificate	Sustainability and Business	520704
MS-SUEL: Sustainability Engineering Leadership, MS	Sustainability Engineer Ldrshp	149999
CERTG-STEN: Sustainability Engineering, Graduate Certificate	Sustainability Engineering	144801
CERTG-SUSC: Sustainability Sciences, Graduate Certificate	Sustainability Sciences	030104
MSSBS-SUBS: Sustainable Building Systems, MSSBS	Sustainable Building Systems	149999
CERTG-SESY: Sustainable Energy Systems, Graduate Certificate	Sustainable Energy Systems	142701
CERTG-TELD: Technology Leadership, Graduate Certificate	Technology Leadership	520216
MS-TNET: Telecommunication Networks, MS	Telecommunication Networks	110901
BA-THEA: Theatre, BA	Theatre	500501
BS-THEA: Theatre, BS	Theatre	500501
BA-THJO: Theatre and Journalism, BA	Theatre/Journalism	500501
CERTG-USLW: United States Law, Graduate Certificate	United States Law	220203
CERTG-URBA: Urban Analytics, Graduate Certificate	Urban Analytics	451201
MS-URBI: Urban Informatics, MS	Urban Informatics	111099
MS-URPP: Urban Planning and Policy, MS	Urban Planning and Policy	451201
CERTG-URBN: Urban Studies, Graduate Certificate	Urban Studies	451201
P-CERTG-USAB: Usability, Graduate Certificate	Usability	111004
CERTG-VCDV: Vaccine Development, Graduate Certificate	Vaccine Development	512006
MS-WNEN: Wireless and Network Engineering, MS	Wireless Network Engineering	141004
CERTG-WOST: Women's, Gender, and Sexuality Studies, Graduate Certificate	Women's Gender Sexuality Stu	050207
CERTG-W GSL: Women, Gender, Sexuality, and the Law, Graduate Certificate	Women, Gender, Sexuality Law	220299

## Resources

The following resources supplement this catalog:

- Academic Calendars (<https://registrar.northeastern.edu/group/calendar/>)
- Class Schedules ([https://service.northeastern.edu/registrar/?id=kb\\_article\\_view&sysparm\\_article=KB000019896&sys\\_kb\\_id=8cad210687d906d0878b0edc0ebb3502&spa=1](https://service.northeastern.edu/registrar/?id=kb_article_view&sysparm_article=KB000019896&sys_kb_id=8cad210687d906d0878b0edc0ebb3502&spa=1))
- University Events (<http://calendar.northeastern.edu/>)

# Course Descriptions

## Accounting (ACCT)

### ACCT 1201. Financial Accounting and Reporting. (4 Hours)

Covers the basic concepts underlying financial statements and the accounting principles followed in the preparation of the balance sheet, the income statement, and the statement of cash flows. Offers students an opportunity to become familiar with accounting terminology and methods designed to enable them to interpret, analyze, and evaluate published corporate financial reports. Wherever appropriate, the course relates current economic, business, and global events to accounting issues. Analyzes how financial reporting concepts affect the behavior of investors, creditors, and other external users. Emphasizes the importance of ethics in financial reporting.

### ACCT 1209. Financial Accounting and Reporting. (4 Hours)

Does not count as credit for business majors. Counts as ACCT 1201 for business minors only. Requires second-semester-freshman standing or above.

### ACCT 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### ACCT 2301. Profit Analysis for Managers and Advisors. (4 Hours)

Focuses on the development and analysis of information for managerial decision making within the firm. Students take a managerial or advisory perspective to conduct cost and profit analyses that support the strategic goals of an organization to manage firm profitability. Topics include#costing products, services, and customers; understanding cost behavior; cost-volume-profit analysis; relevant cost analysis for decision making; budgeting; variance analysis; and performance evaluation. Covers key knowledge and tasks that managers, consultants, and advisors need to understand to help a business run successfully.

**Prerequisite(s):** ACCT 1201 with a minimum grade of D- or ACCT 1209 with a minimum grade of D- or ACCT 1202 with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World

### ACCT 2990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### ACCT 3220. Data Analytics for Advisory Services. (4 Hours)

Covers how data analytics is used to address business problems in the advisory services field. Examines how to master, test, analyze, and present data using Excel, Tableau, and SQL, among other data analytics tools. Emphasizes how to apply data analytics skills to managerial analytics, financial statement analytics, and tax analytics through advisory-type projects and labs.

**Prerequisite(s):** ACCT 2301 with a minimum grade of D- or ACCT 2302 with a minimum grade of D-

### ACCT 3304. Business Law and Professional Ethics. (4 Hours)

Covers business law, professional code of conduct, and the importance of ethical behavior in today's business environment. Examines legal aspects of commercial transactions and business relationships. Specifically, laws relating to contracts and sale of goods under the Uniform Commercial Code, agency law, and product liability law are discussed. May not be used as an accounting concentration elective.

**Prerequisite(s):** ACCT 2301 with a minimum grade of D- or ACCT 2302 with a minimum grade of D-

### ACCT 3401. Financial Reporting and Analysis 1. (4 Hours)

Examines financial reporting concepts, emphasizing the link between them and financial statements. Focuses on both the preparation and interpretation of financial statements, with students also being introduced to basic tools in financial statement analysis, such as ratio and accounting analysis. Gives students the opportunity to understand how management decisions can influence reported income, asset, and liability values, and the importance of ethics when making accounting choices. Offers students the tools necessary to analyze the impact of alternative reporting decisions on financial statements. In addition to accounting majors, this course is ideal for students who wish to pursue careers in corporate finance, investment banking, investment management, or consulting.

**Prerequisite(s):** (ACCT 2301 with a minimum grade of D- or ACCT 2302 with a minimum grade of D- )

**ACCT 3402. Financial Reporting and Financial Statement Analysis. (4 Hours)**

Focuses on the analysis, interpretation, reformulation, and prediction of financial data, including profitability analysis, operating versus nonoperating performance evaluation, credit analysis, reformulation of financial statements, forecasting of financial statements, analysis of intercorporate investments, cash flow analysis, accounting-based equity valuation, cash-based equity valuation, assessment of earnings quality and earnings management, and the assessment of intangible assets. Emphasizes the analysis and application of financial statement information for investment, credit, and management decisions, including advisory and consulting services. Considerable importance is placed on evaluation, interpretation, and use of accounting data for decision making. Such knowledge will enable one to participate in and manage important business decisions.

**Prerequisite(s):** ACCT 2301 (may be taken concurrently) with a minimum grade of D- or ACCT 2302 (may be taken concurrently) with a minimum grade of D-

**ACCT 3403. Advisory Services and Emerging Accounting Systems. (4 Hours)**

Provides an understanding of accounting information systems, with an emphasis on the role of technology and risk analysis. Information is critical for the effective and efficient management of any organization. Addresses concepts and applications relating to the design, analysis, and implementation of accounting systems. Examines the role of e-commerce and Internet-based technologies, including their implications for ethics and privacy, throughout the course.

**Prerequisite(s):** ACCT 2301 with a minimum grade of D- or ACCT 2302 with a minimum grade of D-

**ACCT 3416. Strategic Cost Analysis for Decision Making. (4 Hours)**

Develops understanding of the critical role of cost measurement and management in business decisions and in managing a firm's profitability. Focuses on the strategic use of cost information for planning and control, as well as costing products, services, and customers. Emphasizes the role of management accountants as integral members of decision-making teams and as consultants to senior management. Studies alternate ways of measuring costs to meet different management objectives, the role of budgeting as a planning and management tool, the use of cost analysis as a control tool to help management meet short- and long-term profit objectives, and the importance of ethics in achieving all of these objectives. In addition to accounting majors, this course is ideal for students who wish to pursue a career in finance, general management, operations management, supply chain management, or entrepreneurship.

**Prerequisite(s):** ACCT 2301 with a minimum grade of D-

**ACCT 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ACCT 4412. Auditing and Other Assurance Services. (4 Hours)**

Focuses on issues relevant to the public accounting profession and to internal auditors and managers in private or governmental organizations. Topics include legal liability and ethics, business and audit risk assessment, fraud detection and prevention procedures, planning of audit engagements, audit reports, other assurance services and reports, and the effect of information technology on the audit process. Offers students the opportunity to think critically about issues facing the auditing profession.

**Prerequisite(s):** ACCT 3401 with a minimum grade of D-

**ACCT 4414. Income Tax Determination and Planning. (4 Hours)**

Provides a basic understanding of the structure of the federal income tax system. Taxes can have a significant impact on the viability of a number of personal finance and business decisions. Focuses on the individual taxpayer but also considers the implications for other entities. Tax return projects, research cases, and planning projects help demonstrate the potential impact of taxes on decision making.

**Prerequisite(s):** ACCT 2301 with a minimum grade of D-

**ACCT 4501. Financial Reporting and Analysis 2. (4 Hours)**

Continues ACCT 3401 with a more extensive study of financial statements and the financial reporting rules underlying them. Advanced topics include bonds, pensions, leases, earnings per share, and earnings management. Introduces more advanced financial statement analysis tools. Offers students an opportunity to continue to gain the ethical awareness and the knowledge necessary to analyze the impact of alternative reporting decisions on financial statements.

**Prerequisite(s):** ACCT 3401 with a minimum grade of D-

**ACCT 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ACCT 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of faculty members of the department on a chosen topic. Course content depends on instructor. May be repeated up to three times for a maximum of 8 semester hours.

**ACCT 5201. Foundations of Financial Reporting and Analysis 1. (3 Hours)**

Covers the preparation and interpretation of financial statements. Focuses on the accounting for revenue and accounts receivable, cash, inventory, fixed and intangible assets, and investments. This is the first of a two-course sequence. Department permission required.

**ACCT 5202. Foundations of Assurance Services. (3 Hours)**

Studies the foundations of financial statement auditing. Focuses on the economic importance of auditing and factors relevant to an external auditing professional—audit planning, risk analysis, internal controls, and substantive testing. Includes the report and opinion of the auditor to management and stakeholders. Considers the ethical and legal responsibilities of the auditor. Department permission required.

**ACCT 5203. Foundations of Income Tax Determination and Planning. (3 Hours)**

Studies the foundations of the structure of the federal income tax system. Focuses on the individual taxpayer but also considers the implications for other entities. Demonstrates the potential impact of taxes on decision making using tax return projects, research cases, and planning projects. Department permission required.

**ACCT 5204. Foundations of Financial Reporting and Analysis 2. (3 Hours)**

Continues ACCT 5201 with a more extensive study of financial statements and the financial reporting rules underlying them. Advanced topics include bonds, pensions, leases, earnings per share, and earnings management. Introduces more advanced financial statement analysis tools. Offers students an opportunity to continue to develop the ethical awareness and obtain the knowledge necessary to analyze the impact of alternative reporting decisions on financial statements. Department permission required.

**Prerequisite(s):** ACCT 5201 with a minimum grade of C-

**ACCT 5230. Federal Tax Issues and Analysis. (3 Hours)**

Gives a broad examination of tax authority as it guides action on tax issues including personal and business decisions. Examines the tax structure with a specific focus on the income and expenses for individual taxpayers. Emphasizes property transactions (including the calculation of basis, gain/loss, and the resulting tax treatment). Also incorporates tax planning and research related to these issues. Students who do not meet course prerequisites or restrictions may seek permission of instructor.

**ACCT 5232. Estate and Gift Taxation. (3 Hours)**

Focuses on the study of the taxes common to the transfer of property and wealth. Topics include gift tax deductions and exclusions, estate valuation, state tax deductions and exemptions, and tax rates. Also explores planning opportunities for these wealth transfer taxes. Students who do not meet course prerequisites or restrictions may seek permission of instructor.

**Prerequisite(s):** ACCT 5230 (may be taken concurrently) with a minimum grade of D- or ACCT 5230 (may be taken concurrently) with a minimum grade of C- (Graduate) or ACCT 6230 (may be taken concurrently) with a minimum grade of C-

**ACCT 5255. Forensic Accounting. (3 Hours)**

Offers an overview of occupational fraud and the methodology of fraud examination (i.e., obtaining documentary evidence, interviewing witnesses and potential suspects, writing investigative reports, testifying to findings, and forensic document examination). Offers students an opportunity to learn how to detect the most common types of occupational fraud, determining how each type of fraud is committed, and implementing prevention strategies. Students who do not meet course prerequisites or restrictions may seek permission of instructor.

**ACCT 5256. Internal Auditing. (3 Hours)**

Offers an overview of the internal audit function and explores the duties and responsibilities of the internal auditor. Offers students an opportunity to learn about the planning and organizing of an internal audit department and its coordination with an outside auditor as well as to learn to analyze how the design of an internal control auditing process can reduce risk exposure and enhance internal controls. Students who do not meet course prerequisites or restrictions may seek permission of instructor.

**ACCT 5976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

**ACCT 6200. Financial Reporting and Managerial Decision Making 1. (3 Hours)**

Offers the first of a two-course sequence that focuses on the acquisition, measurement, and management of firm resources. Business managers make strategic decisions about the acquisition and use of a variety of firm resources. Helps enable students to understand and utilize critical information in corporate financial reports to improve business decision making. Offers students the opportunity to learn contemporary methods of financial reporting and analysis used by internal decision makers and external capital providers. Required course for co-op MBA/part-time MBA.

**ACCT 6201. Financial Reporting and Managerial Decision Making 2. (1.5 Hours)**

Continues ACCT 6200, offering the second of a two-course sequence that focuses on the acquisition, measurement, and management of firm resources. Critical to the effective planning, implementation, and management of successful business strategies is the ability to measure and manage the commitment and utilization of entity resources. Focuses on contemporary methods and frameworks used in the process of measuring, analyzing, and allocating firm resources to achieve strategic and operating objectives. Required course for co-op MBA/part-time MBA.

**Prerequisite(s):** ACCT 6200 with a minimum grade of C-

**ACCT 6203. Business Entity Taxation. (3 Hours)**

Provides an in-depth look at the structure of the federal income tax system as it relates to different taxable entities. Emphasizes tax compliance, planning, and research as they impact the decision-making process for corporation and flow-through entities. Also examines the implications of wealth transfer taxes.

**ACCT 6204. Financial Reporting for Integrated Multinational Enterprises. (3 Hours)**

Presents and discusses financial reporting practices for diversified, international business entities. In today's global business environment, many corporations operate diverse economic activities and often conduct those activities across geographic boundaries. Examines accounting and disclosure standards in the United States that are relevant to presenting consolidated financial statements. Also analyzes accounting and disclosure standards in other countries and those developed by international bodies with respect to their effects on reporting entities and the financial markets.

**Prerequisite(s):** ACCT 6203 with a minimum grade of C-

**ACCT 6205. Auditing in a Big Data Environment. (3 Hours)**

Intended for students with a prior course in assurance services and/or auditing. Focuses on the coverage of current significant issues in the assurance services and big data environment. Topics include the impact of technology on the audit process, client risk assessment and statistical data analysis, other assurance services and nonattestation engagements, and the use of complex decision aids. Emphasis is also on contemporary ethical and legal issues confronting the public accounting profession. Offer students the opportunity to think critically about a number of significant issues facing the auditing profession and also introduces impact of big data, the audit judgment, and decision-making process through the completion of a variety of audit cases.

**ACCT 6207. Contemporary and Emerging Issues in Financial Reporting. (3 Hours)**

Focuses on the theoretical concepts of accounting with an examination of standards issued by various professional organizations including the FASB, SEC, and AICPA. Also examines emerging issues in corporate, governmental, and nonprofit financial reporting. Real-world cases are used to illustrate and discuss the complex financial reporting process and ethical issues confronted by the business community and accounting profession.

**ACCT 6216. Financial Reporting for Governments and Nonprofit Entities. (2 Hours)**

Covers business issues and financial reporting standards for state and local governments within the United States, as well as for nonprofit organizations. These organizations make up a large and growing share of the economy, and so it is important to consider whether the funds entrusted to them by taxpayers and donors are being used effectively. These entities have unique ways of reporting their financial results, based on their specific business purposes and the needs of their constituents. The course discusses these reporting methods and the use of the resulting financial reports in evaluating performance within the government and nonprofit contexts.

**ACCT 6217. Corporate Governance, Ethics, and Financial Reporting. (3 Hours)**

Deals with issues related to corporate governance and audit committee mechanisms in preventing financial reporting disasters and in providing high-quality financial reports to global capital markets. Emphasizes the role of the board of directors and its committees, management, shareholders, external auditors, and internal auditors in developing sound ethical practices and a good corporate governance culture. Examines efforts by legislative and regulatory bodies and the accounting profession in improving financial reporting transparency and auditor independence.

**ACCT 6220. Corporate Financial Reporting and Decision Making 1. (3 Hours)**

Examines the development of financial reports including their underlying concepts and measurement theories. Corporate financial reporting is a dynamic process in which information is provided to internal and external decision makers to assist them in the effective allocation of economic resources. Examines the legal, economic, and political processes that influence the financial reporting process.

**ACCT 6221. Corporate Financial Reporting and Decision Making 2. (6 Hours)**

Continues ACCT 6220. Examines corporate financial reporting in the decision-making process. Emphasis is on the economic consequences of alternative financial reporting practices. Provides students with the ability to understand and utilize critical information contained in corporate financial reports to improve business decision making.

**Prerequisite(s):** ACCT 6220 with a minimum grade of C-

**ACCT 6222. Corporate and Governmental/Nonprofit Financial Reporting and Decision Making. (6 Hours)**

Continues the study of corporate financial reporting, covering specialized topics that assume knowledge of the accounting principles covered in the first two courses. Topics include corporate reporting as equity instruments, executive compensation, reporting of fund flows, and reporting and disclosures for corporations engaged in diverse economic activities and those operating across geographic boundaries. Examines accounting and disclosure standards in the United States and in other countries, as well as standards developed by international bodies. Covers financial reporting models used by governmental and nonprofit entities.

**Prerequisite(s):** ACCT 6221 with a minimum grade of C-

**ACCT 6223. Audit and Other Assurance Services. (6 Hours)**

Introduces the attest function and its application to financial statement opinion audits and other assurance services common in today's professional environment. Emphasizes a risk-based approach to audit planning, the internal control structure, and the control environment; the design of test of controls, substantive tests, and the resultant audit report. Topics include audit sampling, audit evidence, audit procedures, workpaper preparation, the impact of information technology on the audit process, and the auditor's responsibility to detect fraud. A primary focus is the auditor's legal and ethical responsibilities. Emphasis is also on operational audits, compliance audits, reviews, compilation, and other attestation services.

**Prerequisite(s):** ACCT 6221 with a minimum grade of C-

**ACCT 6224. Taxation of Individuals and Business Entities. (6 Hours)**

Introduces the principles of taxation including income and expenses, tax accounting methods, and the tax implications of property transactions (including the calculation of basis as well as gains and losses). Emphasizes tax compliance, planning, and research as they impact the decision-making process for individuals, corporations, and flow-through entities.

**Prerequisite(s):** ACCT 6221 with a minimum grade of C-

**ACCT 6226. Strategic Cost Management. (3 Hours)**

Examines the strategic decisions that managers need to make concerning the acquisition, measurement, and management of firm resources. Focuses on the strategic use of cost information for planning and controlling, and the use of cost analysis in making critical business decisions.

**Prerequisite(s):** ACCT 6221 with a minimum grade of C-

**ACCT 6227. Accounting for Business Combinations. (3 Hours)**

Examines the conceptual and practical aspects of business combinations. Topics include mergers and acquisitions, purchase accounting, cost vs. equity method, and accounting for intercompany transactions between a parent company and its subsidiaries.

**Prerequisite(s):** ACCT 6221 with a minimum grade of C-

**ACCT 6228. Contemporary Issues in Accounting Theory. (3 Hours)**

Offers a capstone course on the theoretical concepts of accounting, with a focus on standards issued by various professional organizations including the FASB, SEC, and AICPA. Examines emerging issues in financial reporting. Real-world cases are utilized to illustrate the complex financial reporting issues confronted by the business community and accounting profession.

**Prerequisite(s):** ACCT 6221 with a minimum grade of C-

**ACCT 6229. Accounting for Foreign Currency Transactions. (1 Hour)**

Examines the accounting and reporting issues facing multinational enterprises operating in foreign countries. Business transactions that are denominated in foreign currency may result in risk for the entity as a result of fluctuations in exchange rates. This course evaluates risk management techniques by use of forward exchange contracts and other financial derivatives. Covers reporting issues dealing with the translation of foreign entities financial statements into U.S. dollars and appropriate remeasurement techniques.

**ACCT 6231. Corporations and Shareholders. (3 Hours)**

Provides an in-depth study of the tax issues related to the corporate form and the corresponding tax implications for its shareholders. Given the importance of corporations in the federal income tax system, an understanding of the tax issues related to this type of business is essential for tax professionals. Topics include capital formation and structure, the operations of the corporation, distributions, dividends and redemptions, sales and liquidations, and taxable and tax-free reorganizations.

**Prerequisite(s):** ACCT 6230 with a minimum grade of C- or ACCT 5230 with a minimum grade of D- or ACCT 5230 with a minimum grade of C- (Graduate)

**ACCT 6235. Partners and Partnerships. (3 Hours)**

Provides an in-depth study of the tax issues related to one of the central flow-through entities, the partnership. The increasing popularity of flow-through entities as an organizational form has made an understanding of the tax issues related to this type of entity an important area of study for tax professionals. Topics include capital formation, operations, transactions between the partner and the partnership, distributions, sales of partnership interests, and liquidation of the partnership.

**Prerequisite(s):** ACCT 6230 with a minimum grade of C- or ACCT 5230 with a minimum grade of D- or ACCT 5230 with a minimum grade of C- (Graduate)

**ACCT 6239. State and Local Taxation. (3 Hours)**

Addresses the most common types of taxes imposed by state and local governments. Examines state and local income, sales, excise, property, and city taxes. Emphasis is on the underlying principles governing the application of each type of tax and the interrelationships where they exist.

**Prerequisite(s):** ACCT 6230 with a minimum grade of C- or ACCT 5230 with a minimum grade of D- or ACCT 5230 with a minimum grade of C- (Graduate)

**ACCT 6240. International Taxation: Inbound Transactions. (3 Hours)**

Addresses the taxation of foreign individuals or corporations receiving income from sources, or conducting business, in the United States. With the globalization of the economy, a greater number of taxpayers must consider the impact of international taxation. Topics include the sourcing of income, taxation of passive income, taxation of income connected to a U.S. trade or business, branch-level taxes, issues of foreign-owned U.S. corporations, income tax treaties, and transfer pricing.

**Prerequisite(s):** ACCT 6231 with a minimum grade of C- ; ACCT 6235 with a minimum grade of C-

**ACCT 6241. International Taxation: Outbound Transactions. (3 Hours)**

Examines the federal taxation of U.S. individuals receiving income from sources or conducting business in foreign jurisdictions. An increase in the number of U.S. individuals and corporations operating in other countries has enhanced the importance of an understanding of international transactions for tax professionals. Examines sourcing of income, allocation and apportionment of deductions, foreign tax credits, taxation of U.S. citizens and residents abroad, controlled federal corporations, passive foreign investment companies, foreign currency translations and transactions, and special entities.

**Prerequisite(s):** ACCT 6231 with a minimum grade of C- ; ACCT 6235 with a minimum grade of C-

**ACCT 6243. Advanced Flow-Through Entities. (3 Hours)**

Offers an in-depth look at the tax consequences of businesses formed as flow-through entities (including partnerships, S corporations, and LLCs). Discusses allocation rules, liability sharing rules, disguised sales rules, partnership debt workouts, the S corporation election, and tax treatment of shareholders in an S corporation.

**Prerequisite(s):** ACCT 6231 with a minimum grade of C- ; ACCT 6235 with a minimum grade of C-

**ACCT 6248. Income Taxation of Trusts and Estates. (3 Hours)**

Examines the general rules for the taxation of estates and trusts. Topics include trusts that distribute current income only, grantor trusts, irrevocable trusts, charitable vehicles, income in respect of a decedent, estates and trusts that may accumulate income or may distribute corpus, and treatments of excess distributions and beneficiaries.

**Prerequisite(s):** ACCT 6232 with a minimum grade of C-

**ACCT 6250. Financial Planning for Insurance. (3 Hours)**

Surveys insurance products used for financial planning. Topics include life, accident, health, disability, long-term care, homeowner, auto, and personal liability, with emphasis on personal risk management and the use of insurance products in the financial planning process.

**Prerequisite(s):** ACCT 5232 with a minimum grade of C-

**ACCT 6253. Ethics in the Accounting Profession. (3 Hours)**

Focuses on the roles and ethical responsibilities in the accounting, auditing, and tax professions. Also covers ethical behavior by management as well as the legal guidelines that apply in a business setting.

**ACCT 6254. Accounting Research and Communication. (3 Hours)**

Requires students to research and analyze auditing issues by using quantitative and/or qualitative research methods. Offers students an opportunity to learn how to more effectively communicate those findings in a professional format.

**ACCT 6264. Planning for Estate Tax Issues. (3 Hours)**

Examines advanced strategies for maximizing personal goals (including probate avoidance, tax minimization, and asset protection) related to property passed from one generation to another. Emphasizes trust vs. will planning and other vehicles for estate planning; the principles of estate taxation; the impact of employee benefits, trusts, and their taxations; and life insurance policies and associated annuities.

**ACCT 6265. Tax Accounting for Income Taxes. (3 Hours)**

Investigates the reporting of uncertain positions and accounting treatment accorded current and deferred income tax liabilities and expenses. Topics include accounting for uncertain tax positions, accounting methods and periods (particularly in cases where the accounting and tax records differ), special elections available to taxpayers, installment reporting, inventory methods, long-term contract accounting, and cash vs. accrual reporting.

**ACCT 6292. Tax Research, Practice, and Ethics. (3 Hours)**

Offers students an opportunity to develop and refine their tax research skills through practical exercises. Covers the creation of various sources of tax authority. Exposes students to the procedures used in dealing with the Internal Revenue Service (IRS), with an emphasis on practitioner responsibilities. Reviews the organization of the IRS, filing requirements, appeal procedures, civil/criminal statutes, assessments, and protests. Includes a study of the value and moral judgments inherent in the field of taxation, including client confidentiality, disclosure of false or misleading information, and advice counter to the law or public good.

**ACCT 6318. Analyzing Accounting Data for Strategic Decision Making. (2 Hours)**

Highlights managerial decisions affecting a company's performance in generating revenues, controlling costs, and producing profits. Begins with a brief review of financial accounting, then focuses on the development and use of information, especially financial information, for managerial decisions related to the firm's planning—operations—control cycle.

**ACCT 6345. Financial Accounting and Report Framework and Concepts. (3 Hours)**

Reviews essential financial reporting concepts as they apply to for-profit organizations, not-for-profit entities, and state and local governments. Explores key components of the balance sheet and related transactions including receivables; property, plant, and equipment; intangible assets; payables; long-term debt; and equity transactions. Examines the financial accounting implications of advanced topics such as accounting changes and error corrections, contingencies, revenue recognition, income tax accounting, and lease accounting. Introduces the fundamental fund structures used to account for the financial activities of state and local governments.

**ACCT 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ACCT 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

## Accounting - CPS (ACC)

### ACC 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### ACC 2100. Financial Accounting. (3 Hours)

Examines the development, objective, and purpose of financial statements. Emphasizes the preparation, analysis, and use of these statements to make operating, financial, and investment decisions. Covers the underlying methods, concepts, principles, and measurement theories. Topics include understanding the operating cycle, receivables, inventories, plant and equipment, intangible assets, liabilities, bonds, ownership, and stockholders' equity. Special topics include the mathematics of present value theory, calculations, and applications.

### ACC 2200. Managerial Accounting. (3 Hours)

Examines the fundamental tools and principles of managerial accounting for decision-making purposes, including planning and control. Covers cost determination, assignment, definition, and behavior. Requires students to prepare management accounting reports and statements for internal decision-making purposes, including the preparation of budgets and contribution margin statements. Topics include job order, process costing, activity-based costing (ABC), inventory techniques, variance analysis, CVP analysis, and budgeting.

### ACC 2300. Cost Accounting. (3 Hours)

Examines the concepts and methodologies useful to understand a cost accounting system for business decision-making, cost control, and performance assessment. Studies cost analysis and explores statistical methods in measuring cost behavior, overhead, and fixed costs. Introduces capital budgeting techniques for equipment replacement and long-term asset management given the relevant range of productive capacity. Compares and analyzes decentralization, segment, and divisional management accounting. Topics include marginal cost relevancy, make-or buy decisions, multiple product cost assignment and production methods, joint costs and by-products, responsibility accounting, activity-based costing, just-in-time cost systems, economic value added, residual income, the balance scorecard, and return on investment techniques.

### ACC 3201. Financial Reporting and Analysis 1. (3 Hours)

Examines in greater depth the foundational principles, concepts, and measurement theories relating to financial reporting and stewardship. Focuses on the objectives of financial statements for various users such as lenders, investors, and various stakeholder groups. Emphasizes the accounting conceptual framework, including the guidance and standards promulgated by various standards-setting and regulatory bodies. Topics include the measurement, valuation, and disclosure of receivables, inventories, tangible and intangible assets, depreciation methods, revenue-recognition principles, and required footnotes.

**Prerequisite(s):** ACC 2100 with a minimum grade of D-

### ACC 3202. Financial Reporting and Analysis 2. (3 Hours)

Continues the examination in greater depth of the foundational principles, concepts, and measurement theories relating to financial reporting and stewardship. Focuses on the objectives of financial statements for various users such as lenders, investors, and various stakeholder groups. Emphasizes the accounting conceptual framework, including the guidance and standards promulgated by various standards-setting and regulatory bodies. Topics include the measurement, valuation, and disclosure of liabilities, bond obligations, retirement obligations, reconciliation of deferred taxes and required tax disclosures, various corporate ownership interests, stock options, accounting changes, statement of cash flows, and required footnotes.

**Prerequisite(s):** ACC 3201 with a minimum grade of D-

### ACC 3330. Principles of Auditing. (3 Hours)

Examines audit principles, concepts, and standards relevant to the attest function. Explores the objectives of audited financial statements performed by certified public accountants in compliance with AICPA auditing standards, PCAOB standards and guidelines, and SEC rules and regulations for publicly held companies. Also explores the objectives of audited financial statements and other lower-level services (such as reviews and compilations) performed for privately held nonpublic companies. Topics include ethical and legal liabilities of the auditor, including the independence and skepticism requirement, internal control, audit evidence, audit procedures, audit compliance and substantive testing, statistical sampling, transaction cycle testing, and the role of the audited reports on the efficiency of capital markets.

**Prerequisite(s):** ACC 3202 with a minimum grade of D-

**ACC 3410. Principles of Taxation. (3 Hours)**

Covers the objectives and principles of taxation, including the economic policy underlying various tax systems—property, consumption, value added, federal, and state income tax regimes. Explores the marginal tax structure and studies the component parts of the tax accounting equation in full, including the definitions and terminology described in the U.S. tax code. Emphasizes the tax compliance responsibilities and tax accounting methods and required reporting obligations for individuals, corporations, and various pass-through entities such as partnerships and subchapter S corporations.

**Prerequisite(s):** ACC 3201 with a minimum grade of D-

**ACC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ACC 4320. Financial Statement Analysis. (3 Hours)**

Explores the process, tools, principles, and concepts of financial reporting, financial statement analysis, and valuation used by investors and analysts. Covers analysis of financial information and firm-specific data, emphasizing the structure of financial statements. Focuses on use of this data for equity and debt valuation as part of security analysis and portfolio management. Studies analysis of individual investments, focusing on pricing shares of stock and creating valuation models and specific criteria used in lending decisions. Topics include models of intrinsic value; comparison of accrual accounting and discounted cash flow approaches to valuation; analysis of firm profitability, growth, risk analysis, and value generation; and assessment of accounting quality, forecasting earnings and cash flows, pro forma analysis for strategy and planning, and study of nonfinancial metrics.

**Prerequisite(s):** (ACC 3202 with a minimum grade of D- or ACC 4307 with a minimum grade of D-); FIN 3310 with a minimum grade of D- ; ACC 3410 (may be taken concurrently) with a minimum grade of D-

**Attribute(s):** NUpath Writing Intensive

**ACC 4410. Advanced Taxation. (3 Hours)**

Continues the study of taxation, including tax-planning strategies, the tax legislative process, tax controversies and litigation, the hierarchy of tax authorities, and tax research and writing techniques. Emphasizes the tax-planning techniques and opportunities for individuals and businesses to avoid or minimize the present value of tax liabilities through property acquisitions; exchanges and dispositions; deferred and installment sales; corporate reorganizations; liquidations; and other pass-through entity structures such as limited liability companies, trusts, estates, and personal holding companies. Integrates the analysis of legislative motives to provide incentives to promote desired economic and social behavior and to exact penalties to discourage undesirable economic and social activity.

**Prerequisite(s):** ACC 3410 with a minimum grade of D-

**ACC 4420. Advanced Accounting. (3 Hours)**

Covers Securities and Exchange Commission reporting requirements, including segment and interim reporting requirements for large publicly held companies. Focuses on the equity method of accounting for investments; consolidations of financial information and consolidated reporting requirements for activities subsequent to the date of acquisition; consolidated financial statements as they pertain to outside ownership, intercompany asset transactions, and ownership patterns and income taxes; and intercompany debt, consolidated statement of cash flows, and other multi-entity issues. Other related matters covered include multinational accounting for foreign currency transactions and financial instruments, including the currency translation of foreign entity financial statements. Special advanced topics include accounting for partnerships, estates and trusts, fund accounting, bankruptcy liquidations and reorganizations, and accounting for governmental units and not-for-profit entities.

**Prerequisite(s):** (ACC 3202 with a minimum grade of D- or ACC 4307 with a minimum grade of D-); ACC 3410 with a minimum grade of D-

**ACC 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**ACC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ACC 6210. Forensic Accounting Principles. (3 Hours)**

Seeks to provide students with a broad conceptual overview of the field of forensic accounting, the key internal controls required to deter/detect frauds or abuse, and the newly enacted corporate governance laws. Covers the roles, responsibilities, and requirements of a forensic accountant; basic legal and fraud examination theory; ethics in business; identifying the major types of cash, payroll, and other financial fraud schemes; detailed examination of the proper required internal audit controls (transaction authorization, segregation of duties, supervision, adequate documentation and records, physical safeguards, independent verification); and accounting/auditing standards and corporate governance needed to comply with the AICPA, SAS, CFE, government regulations, and Sarbanes-Oxley 2002 legislation. Discusses actual fraud cases to highlight the impact of auditing and forensic accounting on businesses and our society.

**ACC 6220. Dissecting Financial Statements. (3 Hours)**

Offers students an opportunity to learn how to review, detect, and investigate possible financial statement concerns of publicly and privately held businesses, as well as nonprofit organizations and family businesses. Financial records of the companies studied span a variety of industries. Topics include legal elements of financial statement fraud, management's and auditor's responsibilities, improper revenue/sales recognition, inadequate disclosure of related-party transactions, improper asset valuation, improper deferral of costs and expenses, financial statement red flags, and inadequacies in management's discussion and analysis. Addresses such factors as off-balance-sheet activity, liquidity, financial performance indicators, unreported intangibles, and lease auditing. Typical cases could include WorldCom, Enron, Rite Aid, Crazy Eddie, and ESM Government Securities.

**ACC 6230. Investigative Accounting and Fraud Examination. (3 Hours)**

Offers students an opportunity to learn how to identify and investigate accounting frauds and irregularities. Includes the in-depth review of sophisticated fraud schemes; how fraudulent conduct can be deterred; how allegations of fraud should be investigated and resolved; the recovery of assets; methods of writing effective reports; complying with SAS 82 and other fraud standards; and recent antiterrorist and money-laundering regulations, including the Patriot Act of 2002. Sessions are interactive, with students working through actual cases, developing investigative strategies, and seeking to prove how the fraud was committed. Topics covered include acts of skimming, cash larceny, check tampering, register disbursement schemes, billing schemes, payroll and expense reimbursement schemes, improper accounting of inventory and other assets, corruption, bribery, conflicts of interest, security fraud, and insurance fraud.

**Prerequisite(s):** ACC 6210 with a minimum grade of C- or ACC 6220 with a minimum grade of C-

**ACC 6240. Litigation Support. (3 Hours)**

Covers the litigation process and civil and criminal statutes used to prosecute white-collar crimes. Offers students the opportunity to learn the appropriate analytical tools to quantify values for future earnings or damages resulting from fraud, breach of contract, or insurance disputes and to perform business valuations, including those arising from hostile situations such as divorce. Topics covered include how to assist in obtaining documentation necessary to support or refute a claim, assist in the examination for discovery, formulate questions to be asked regarding the financial evidence, review an opposing expert's damages report and report on both the strengths and weaknesses of the positions taken, assist with settlement discussions and negotiations, and provide assistance at trial in testimony or with cross-examination.

**ACC 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Advanced Manufacturing Systems - CPS (AVM)****AVM 1100. Fundamental Measurement Analysis. (3 Hours)**

Covers Measurement System Analysis (MSA), which is of critical importance to manufacturing. Its proper utilization allows companies to identify quality and production issues and to prioritize and to address them accordingly. Introduces fundamentals of measurement systems, statistical concepts, sources of variation, measurement strategies, and planning. Reviews and explores measurement system variability and techniques. Discusses linearity, repeatability, reproducibility, and production capability using Gage repeatability & reproducibility (R&R), process capability (Cp), and process capability index (Cpk).

**AVM 1150. Fundamentals of Manufacturing Systems. (3 Hours)**

Introduces the basic elements of manufacturing process including planning, operations, materials supply, quality control, process integration, and environmental compliance. Discusses advanced and micro-manufacturing methods including 3-D printing and other additive manufacturing methods. Evaluates design for manufacturing methods, computer integration, automation and robotics, as well as Industrial IoT, in technical and business aspects.

**AVM 1200. Fundamentals of Safety, Health, and Environmental Issues. (3 Hours)**

Presents a comprehensive overview of health and safety issues as they relate to the environment and the workplace. Introduces students to the scientific and technical foundations of the subject including environmental pollutants and biological, chemical, and physical agents. Policy decisions and safety regulations provide a solid basis for students to recognize hazards at the workplace and in the environment. Offers students an opportunity to become familiar with standard workplace policies, procedures, and guidelines. Covers personal protection, recording, and accident investigation procedures. Subjects are presented and discussed based on historical examples such as the Bhopal gas leak, the Chernobyl explosion, and others.

**AVM 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AVM 2200. Composite Materials and Applications. (3 Hours)**

Provides a comprehensive training covering fundamental principles, technologies, and applications of composite materials. Offers students an opportunity to gain an understanding of strengthening mechanisms in fiber, particle, metal-matrix, ceramic-matrix, carbon-carbon, and hybrid composites and to learn how to calculate elastic modulus, critical fiber length, and other parameters. Discusses design considerations of aramid-reinforced composites, such as Kevlar, and other composite materials in terms of their applications. Reviews applications of composite materials in aviation, defense, sports, and advanced manufacturing.

**AVM 2250. Materials Performance and Applications. (3 Hours)**

Offers students an opportunity to obtain a fundamental understanding of relationships of materials composition, structure, treatment, and performance. Relates these topics to manufacturing processes used to achieve targeted performance characteristics. Emphasizes materials characterization, data collection, processing, and analysis. Incorporates failure analysis into the discussion and reviews in terms of product performance, durability, and cost. Evaluates advanced surface engineering and design methods for improving product performance. Reviews materials performance in aerospace, robotics, and semiconductor industries.

**AVM 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AVM 3000. Materials Processing. (3 Hours)**

Offers students an opportunity to learn the fundamental principles of materials processing. Discusses a variety of ferrous and nonferrous metals, alloys, ceramics, and plastics in terms of processing methods, technologies, and manufacturability. Considers microstructural changes related to product performance and specifications. Uses phase diagrams and isothermal transformational diagrams to explain materials transformations and properties. Evaluates thermal, mechanical, composite, joining, surface engineering, and other processing methods from the point of view of applications, scalability, and cost.

**AVM 3100. Nondestructive Testing. (3 Hours)**

Reviews and discusses fundamental principles of nondestructive testing (NDT) in-depth. NDT methods are an essential part of today's advanced inspection processes due to their efficiency, speed, and cost-effectiveness. Introduces radiation, optical, electromagnetic, acoustic, and other methods of NDT. Reviews manufacturing, materials, and medical applications. Presents recent advances in portable NDT equipment in terms of their use in manufacturing, quality control, and systems.

**Prerequisite(s):** MET 3300 with a minimum grade of D

**AVM 3500. Business Operations and Supply Chain. (3 Hours)**

Offers a look at real-world challenges faced in supply chain management. Explores gathering market data on an industry and creating a should cost model. Offers students an opportunity to gain exposure to pricing indices and realize risks that can impact businesses on a day-to-day basis. Uses tools such as SWOT analyses and Porter's Five Forces to promote strategic thinking. Expands into business continuity planning and scenario planning. Witnesses the importance of planning ahead on communication, backup plans, and safety stocks. Students are introduced to supply chain KPIs, prepared for negotiations, and participate in negotiations. Finally, offers students an opportunity to learn the business impacts of choosing to select a new vendor to add to an organization.

**Prerequisite(s):** MGT 2220 with a minimum grade of D-

**AVM 4100. Mechatronics. (3 Hours)**

Introduces students to design and other requirements of essence to advanced manufacturing engineers. Provides essential multidisciplinary information in mechanical, electrical, and computer engineering, as well as in electronics and in materials. Discusses sensors, actuators, and computer control systems and integration in view of application in different industries. Reviews robotics, automation, intelligent devices, and cloud integration as essential components of the next industrial revolution.

**Prerequisite(s):** MET 2000 with a minimum grade of D- ; (EET 3100 with a minimum grade of D- or EET 3300 with a minimum grade of D- )

**AVM 4150. Automation 1. (3 Hours)**

Offers an overview of the important concepts of industrial automation: analog/digital; input/output; continuous, synchronous, and asynchronous processes; components and hardware; process and machine systems; and automated machinery. Offers students an opportunity to gain thorough knowledge of the internals of a Programmable Logic Circuit (PLC), as well as an opportunity to create simple programs for a set of control requirements. Requires students to undertake a project to design a control scheme, program the same on PLC simulation software, and test the operation of that program.

**Prerequisite(s):** EET 3300 with a minimum grade of D-

**AVM 4160. Automation 2. (3 Hours)**

Continues AVM 4150. Presents an overview of the important concepts of industrial automation: analog/digital; input/output; continuous, synchronous, and asynchronous processes; components and hardware; process and machine systems; and automated machinery. Examines the internals of a programmable logic circuit and how to create simple programs for a set of control requirements. Requires students to undertake a project to design a control scheme, program the same on PLC simulation software, and test the operation of that program.

**Prerequisite(s):** AVM 4150 with a minimum grade of D-

**AVM 4250. Hydraulics and Pneumatics. (3 Hours)**

Examines energy transmission based on hydraulics and pneumatics. Introduces basic fluid dynamics and offers students an opportunity to gain basic knowledge of functionality and design of pumps, motors, cylinders, and valves. Studies calculation methods for hydraulic/pneumatic components and systems, as well as basic system principles for control of position, velocity and speed, force and torque, and power. Emphasizes measurement methods in hydraulic and pneumatic systems.

**Prerequisite(s):** MTH 2105 with a minimum grade of D- ; PHY 1200 with a minimum grade of D-

**AVM 4300. Advanced Manufacturing and Additive Processes. (3 Hours)**

Provides a comprehensive overview of manufacturing approaches and technologies used in today's industry, including one of the fastest-growing areas—additive manufacturing (AM). Offers students an opportunity to understand the fundamentals of AM and 3-D printing, the key AM processes, including technologies based on material extrusion, vat photopolymerization, powder bed fusion, and binder and material jetting. Focuses on benefits of rapid prototyping and its application to aerospace, automotive, consumer good business, and healthcare. Includes important design and fabrication considerations.

**Prerequisite(s):** AVM 1150 with a minimum grade of D

**African Studies (AFRS)****AFRS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AFRS 2392. African Diaspora. (4 Hours)**

Explores the creation and transformation of the African Diaspora—connections among communities of African descent in either Africa, the Americas, Europe, and/or Asia—from 1500 to the present. Emphasizes connections among themes of migration, identity, and popular culture with a special focus on 20th- and 21st-century contributions.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**AFRS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AFRS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AFRS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AFRS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Africana Studies (AFCS)

**AFCS 1101. Introduction to African American and Africana Studies. (4 Hours)**

Explores the broad interdisciplinary spectrum of African American and Africana studies. Provides an introductory overview of the field and offers an opportunity to identify areas for more specific focus.

**Attribute(s):** NUpath Difference/Diversity

**AFCS 1113. Black Popular Culture. (4 Hours)**

Surveys U.S. and international Black popular culture from the mid-1950s to the present through music, movies, music videos, and other forms of multimedia, paying close attention to social commentary, political critique, economic inference, cultural formation, explications of religious and spiritual beliefs, and the like. Discusses and ponders issues of representation, identity, values, and aesthetics. Offers students an opportunity to rethink and reexamine the intent, impact, and circulation of Black popular culture as a method and means of expression and communication.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**AFCS 1140. Introduction to African-American History. (4 Hours)**

Surveys the development of African Americans in the United States from their African background to the present. Covers medieval and early modern societies in West and Central Africa; the transatlantic slave trade; the evolution of slavery from the colonial period through the Civil War; free blacks; Reconstruction; migration; civil rights; and black nationalism. Considers gender relations throughout the entire period and emphasizes how an historical perspective helps to inform discussions of contemporary issues.

**AFCS 1225. Gender, Race, and Medicine. (4 Hours)**

Examines the basic tenets of "scientific objectivity" and foundational scientific ideas about race, sex, and gender and what these have meant for marginalized groups in society, particularly when they seek medical care. Introduces feminist science theories and contemporary as well as historical examples to trace the evolution of "scientific truth" and its impact on the U.S. cultural landscape. Offers students the opportunity to question assumptions about science and view the scientific process as a site for critical analysis.

**Attribute(s):** NUpath Difference/Diversity

**AFCS 1261. Global Caribbean. (4 Hours)**

Focuses on the culture and history of Caribbean societies in global perspective. Explores Caribbean creativity and resilience across English, French, and Spanish linguistic and political spheres with examples from literature, art, music, food, technology, and performance. Considers the global reach of Caribbean diasporas, highlighting the long local histories of Caribbean communities in Boston. Follows four key themes—indigeneity, blackness, diaspora, and creolization—to understand this unique point of entry for the study of race, gender, and sexuality in the Americas.

**AFCS 1270. Introduction to Global Health. (4 Hours)**

Introduces global health in the context of an interdependent and globalized world focusing on four main areas of analysis: infrastructure of global health; diseases; populations; and terms, concepts, and theories. While the focus is on lower-income countries, the course examines issues in a broader global context, underscoring the interconnections between global health disparities and global health policy response. Applies case studies describing interventions to improve healthcare in resource-poor settings in sub-Saharan Africa and elsewhere to help illuminate the actors, diseases, populations, and principles and frameworks for the design of effective global health interventions.

**Attribute(s):** NUpath Societies/Institutions

**AFCS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**AFCS 2270. Race, Ethnicity, and Inequality. (4 Hours)**

Focuses on the social construction of race and ethnicity and the nature of dominant/minority relations in the United States. Emphasizes the peculiar evolution of race relations in U.S. history, the political and economic conditions that have transformed race relations, and the nature of contemporary racial and ethnic relations in the United States. Topics include immigration, ethnic and racial identity, discrimination, and race-based policies (e.g., residential restrictive codes, Jim Crow segregation). Offers students an opportunity to develop a critical lens from which to observe and interpret contemporary debates over structural racism.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**AFCS 2296. Early African-American Literature. (4 Hours)**

Surveys the development and range of black American writers, emphasizing poetry and prose from early colonial times to the Civil War. ENGL 2296 and AFM 2296 are cross-listed.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**AFCS 2318. New England Stories: Storytelling and the African American Experience. (4 Hours)**

Delves into the fascinating stories of African Americans who have called New England home, from the seventeenth century up to the present. Discusses themes such as freedom and slavery, migration, and civil rights. Introduces an interdisciplinary framework for understanding Black identity formation, activism, and cultural as well as intellectual traditions amid the long struggle for justice.

**Prerequisite(s):** ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**AFCS 2325. Black Feminist Studies. (4 Hours)**

Invites students to study the history and contemporary landscape of Black feminist scholarship. Covers a range of disciplines and historical periods to introduce students to important texts and theoretical developments in this vast and interdisciplinary field.

**Prerequisite(s):** ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**AFCS 2330. Afro-Latin American Studies. (4 Hours)**

Introduces the history of Afro-Latin America and of Black identities particular to this region. Frameworks such as transnational migration and diaspora provide an entry to the specific histories of African-descended people in the countries in the region known as Latin America and contemporary interpretations and revisions of that history. Covers topics including the history of slavery in the Americas; the Haitian Revolution; debates about "racial democracy"; and the relationship between gender, race, and empire. Explores the relationship between scholarship and struggle, social analysis, and social transformation.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**AFCS 2337. African American History Before 1900. (4 Hours)**

Traces the presence of African-descended people in North America. Emphasizes the historical and cultural links between Africa and North America that have shaped the Black experience in the United States. Explores and analyzes the institution of slavery, the role of free Black communities, the Civil War and emancipation, and Black leadership and protest during the Reconstruction era. Introduces students to the historian's craft, theoretical debates concerning race and gender, and the persistence of the past in the present.

**Prerequisite(s):** ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**AFCS 2355. Race, Identity, Social Change, and Empowerment. (4 Hours)**

Examines racism, racial identity, and theories of social change and racial empowerment primarily within the U.S. context. Highlights different ways in which racism and racial privilege have been experienced by different racial communities, more specifically at the micro-, meso-, and macro-levels. Offers students an opportunity to learn ways to promote racial empowerment and equity. Using theory from primarily psychology and sociology, the course investigates the impact of social systems and institutions on individual-level and group experiences of racism. Investigates students' own racial identities, a deeper understanding of institutional inequalities and intersectionality, and practical skills in leadership and community building that can promote positive social change and racial equality.

**Prerequisite(s):** ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity

**AFCS 2380. Black Families and Incarceration. (4 Hours)**

Focuses on how the Black family functions, both interpersonally and as a social unit within a carceral state. Introduces the diverse institutional, cultural, and historical issues relating to past and present circumstances from the effects of slavery and colonization on the Black family structure. Explores policies and practices within carceral institutions dealing with childhood, motherhood, and fatherhood. Assesses the social and psychological harms of incarceration on Black children and their families.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity

**AFCS 2390. Africa and the World in Early Times. (4 Hours)**

Addresses the place of Africa in the world, from human evolution to the establishment of large-scale iron-making societies. Examines debates on the evolution of man in Africa and migrations to other regions. Traces the formation and spread of language groups, the rise of agriculture, formation of family and political structures, and patterns of trade up to 1000 C.E.

**AFCS 2410. Possession, Sacrifice, and Divination in African Diasporic Religions. (4 Hours)**

Examines religious thought and rituals and the Diaspora in a comparative context. Topics include traditional religions, Islam, Christianity, and Judaism in Africa, and the Diaspora. Emphasizes the transformation of religions practiced in Africa when African captives were forced into the three slave trades affecting the continent of Africa: trans-Saharan, Indian Ocean, and transatlantic.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**AFCS 2455. American Women Writers. (4 Hours)**

Surveys the diversity of American women's writing to ask what it means to describe writers as disparate as Phillis Wheatley, Edith Wharton, Toni Morrison, and Alison Bechdel as part of the same 'tradition.' With attention to all genres of American women's writing, introduces issues of race, genre and gender; literary identification; canons; the politics of recuperation; silence and masquerade; gender and sexuality; intersectionality; sexual and literary politics, compulsory heterosexuality, and more.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**AFCS 2600. Issues in Race, Science, and Technology. (4 Hours)**

Examines the social impact of diverse forms of technological development and application that will have sweeping effects on the everyday lives of individuals, groups, governments, and societies in the twenty-first century. The global, transforming effects of technology as it affects communities of color in the United States and internationally are explored in three main areas: the computer, DNA, and quantum revolutions. Topics include the digital divide, minority media ownership, human cloning, the "dot.com" phenomenon, race and cultural representations in cyberspace, and biopiracy. Lectures, class discussions, fieldwork, and interaction with leaders in these various fields are integral elements of the course.

**AFCS 2618. Community Psychology. (4 Hours)**

Seeks to familiarize students with some of the topics, theories, and research methods employed by psychologists and other social scientists working in the area of community psychology. Community psychologists study people in their social contexts, emphasizing the mutual influences that individuals and communities have upon each other. Rather than attempt to understand and treat problems at the individual level, research in community psychology aims to offer practical solutions to social problems. Focuses on race, gender, and class. Offers students an opportunity to focus on a particular community, which they may utilize for data collection, and to develop survey instruments/interview schedules; collect data; and analyze and interpret the findings with a qualitative design, if necessary.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**AFCS 2619. Race and Religion in Film. (4 Hours)**

Explores how relationships between historical and contemporary representations of African Americans, other persons of the African Diaspora, and the continent of Africa have been presented in film in relation to religious themes. An interdisciplinary study in how race and religion are represented in ways that reflect and actively contribute to "real world" faith beliefs, experiences, and actions. Critically examines how representations of "the Other" compared to "the chosen" relate to the intersectionality of race, religion, class, national origin, gender, sex, and sexuality. Provides a framework for ethical analysis of how societal institutionalized systems of power influence beliefs about racialized identities and religion.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**AFCS 2690. Boston in Literature. (4 Hours)**

Explores the various ways in which the city of Boston and its environs are represented in literature and other media. Each semester, the course focuses on a different aspect of Boston in literature, such as representations of Boston's different communities, different historical eras, particular genres or concepts associated with the city, and so forth. Offers students an opportunity to build upon their readings about the city by experiencing independent site visits, class field trips, guest speakers, and other activities. In addition to a culminating group or individual research project about Boston, students may also have the opportunity to participate in a community-based reading project. AFAM 2690 and ENGL 2690 are cross-listed.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Integration Experience, NUpath Interpreting Culture

**AFCS 2900. Swahili, Culture, and Politics in Kenya. (4 Hours)**

Introduces and immerses students in Kenyan African culture, the Swahili language and politics, and studies their impact on the everyday life of the local population. Offers students an opportunity to learn Swahili, which is the national language of Kenya; its use in a context of varied indigenous languages; and cultural dynamics. Exposes students to the major issues that characterize everyday life in rural and urban settings through visits to and stays in the rural areas and transect walks in villages and urban communities. Students visit projects run by community-based organizations, observing the everyday life of ordinary Kenyans and attending formal and informal classes and settings on Swahili language, culture, and the local politics.

**Attribute(s):** NUpath Integration Experience

**AFCS 2973. Topics in Africana Studies. (4 Hours)**

Introduces specific topics in Africana studies as selected by the instructor. Topics will vary. May be taken once for a maximum of 8 semester hours.

**AFCS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**AFCS 2991. Research Practicum. (2-4 Hours)**

Involves students in collaborative research under the supervision of a faculty member. Offers students an opportunity to learn basic research methods in the discipline. Requires permission of instructor. May be repeated once for up to 4 total credits.

**AFCS 3120. Race, Crime, and Justice. (4 Hours)**

Provides students with an overview of the role and treatment of racial/ethnic minorities in the criminal justice system. Covers historical and theoretical frameworks for understanding the relationship between race, crime, and criminal justice. In so doing, students become familiar with trends and patterns in criminal offending by racial/ethnic minorities, as well as system response to such behavior.

**Attribute(s):** NUpath Difference/Diversity

**AFCS 3210. Black Abolition Studies: Carcerality, Liberation, and Resistance. (4 Hours)**

Analyzes how Black people have resisted carcerality in social and political organizing from the 16th century to the present. Explores historical understandings of abolition as the end of slavery and the current abolition project of ending prisons, policing, and other institutions that are shaped by the legacy of slavery. Offers students an opportunity to critically analyze and engage contemporary social movements and political discourse in their everyday lives. Topics include the Haitian Revolution, maroon communities, 19th-century slavery abolitionists, anti-lynching organizing, chain gangs, Black political prisoners, contemporary carceral abolition, and abolitionist texts and films.

**Attribute(s):** NUpath Difference/Diversity

**AFCS 3305. Beyond the Binary: Race, Sex, and Science. (4 Hours)**

Considers how gender, race, and sexuality have been treated in science, focusing primarily on the 19th and 20th centuries. Examines the history of ideas about gender, race, and sexuality as reflected in fields such as biology, psychology, endocrinology, and neuroscience. Discusses contraceptive and reproductive technologies, pharmaceutical trials, the gendering of scientific professions, and recent studies that use algorithmic predictions of sex or sexual orientation. Uses close reading techniques and discussions to advance student expertise.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**AFCS 3323. Race, Inequality, and the Law. (4 Hours)**

Examines the relationship between and material impact of race, public policies, and the administration of justice in the United States. Explores the ways the American legal system and political institutions have constructed and reinvented racial categories and their legal and social implications over time. Emphasizes the legacy of this legal history by examining how race and racial inequities intersect with contemporary public policy and social justice issues, including educational equity, employment discrimination, policing, and technology.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**AFCS 3404. African American Rhetorical Traditions. (4 Hours)**

Examines and organizes the ways that African Americans have historically maintained their humanity and negotiated freedom through discourse. Explores various discursive practices of African American discourse communities—such as the enslaved, abolitionists, feminists, nationalist/revolutionaries, and entertainers—to engage discussions about freedom, access to democracy, racial uplift, gender equity, and the discursive and recursive nature of racial identity. Studies historical contexts and current sociopolitical dynamics emphasizing the Black Jeremiad, civil rights rhetoric, the Black Power Movement, Black Feminist Thought, and Hip-Hop.

**Prerequisite(s):** ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**AFCS 3424. Epidemiology of Pandemic Diseases and Health Disparities in the African Diaspora. (4 Hours)**

Examines the epidemiology and determinants of diseases and the public health practice among continental African peoples and African-derived populations in the Americas and elsewhere in the African Diaspora. Emphasizes such epidemic diseases as malaria, yellow fever, tuberculosis, smallpox, the current AIDS pandemic, obesity, and cancer. The course also aims to critically address the breadth of factors behind these pandemics, such as socioeconomic, political, health system, behavioral, and genetic. A cross-cutting theme throughout the course is the entrenched health disparities in society.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**AFCS 3512. Religion, Race, and Politics. (4 Hours)**

Engages the intersections of religion, race, and political power through cultural history, ethnography, and lived religions. Explores the social and cultural categories of our historical and contemporary worlds. Examines how some peoples' histories have been centered, while others' histories have been marginalized. Explores religion as a social category that reproduces existing relations of power while alternatively supporting social revolution and change. Class engagements are centered on theories of power, understandings of difference, and changes in social structures over time, from the colonial period to the present (1500s–2000s).

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**AFCS 3664. Black Poetry and the Spoken Word. (4 Hours)**

Focuses on the black poet's place in the history of American poetry. Considers black poetry as both written words and spoken words.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**AFCS 3900. Gender and Black World Literatures. (4 Hours)**

Explores different aspects of the literary and cultural productions of black women throughout history. Examines writing by women in the United States—like Octavia Butler, Zora Neale Hurston, and Toni Morrison—in addition to writing by women across the global African diaspora—like Chimamanda Adichie and Jamaica Kincaid. Students may also engage with theories such as Black feminism, womanism, or intersectionality; consider issues of genre such as the novel, poetry, or science fiction; and explore key themes such as class, sexuality, and disability. AFRS 3900, WMNS 3900, and ENGL 3900 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**AFCS 3990. Elective. (1-4 Hours)**

Offers elective credit for course taken at other academic institutions.

**AFCS 4526. Afro-Asian Relations in the Americas. (4 Hours)**

Examines the comparative racialization of Blacks and Asians in the Americas and relations between these communities. Introduces sociological theories of race/ethnicity, a chronology of Afro-Asian relations in the United States, and the impact of 1970s deindustrialization and post-1965 Asian immigration. Covers the internationalism of Black and Asian leaders (e.g., W.E.B. du Bois and Mao Tse-Tung) in the developing nations and the overlapping Civil Rights, Black Power, and Asian American movements.

**Prerequisite(s):** SOCL 1101 with a minimum grade of D- or ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**AFCS 4588. Literature in Context. (4 Hours)**

Places writers in the context of a special theme or specific geographic location; for example, students might discuss a group of writers influenced by their commitment to revolution or radical thinking, or in the context of a geographical national or regional setting (i.e., Black France, Haiti and the Dominican Republic, Francophone West Africa).

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**AFCS 4700. Capstone. (4 Hours)**

Offers students the opportunity to prepare a professional research project under the close supervision of a scholar interested in students' particular research areas.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**AFCS 4939. Community Health, Culture, and Development in Kenya. (4 Hours)**

Introduces the community health and development arena in Kenya. Community development has been presented as the panacea to many of Africa's problems, including leadership, democracy, conflict, disease, and poverty. Through teaching, research, and action, the course seeks to expose and sensitize students to the global and local debate on poverty, primary healthcare, and community development. Offers students an opportunity to gain hands-on experiences in some of the major determinants and solutions to poverty and disease by interacting with community stakeholders and organizations in a variety of cultural, rural, and urban settings and through visits to, and participating in, projects run by community-based organizations.

**Attribute(s):** NUpath Integration Experience

**AFCS 4973. Topics in African American Studies. (4 Hours)**

Offers focused analysis of a special topic in African American studies. Course content may vary from term to term. May be repeated up to three times.

**AFCS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**AFCS 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**AFCS 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**AFCS 5001. Special Topics in Race and the Law. (4 Hours)**

Explores the various questions, relationships, and connections between the law and racial issues and concepts. Each offering focuses on a special topic such as reparations, civil rights, gender, or the environment and energy policies. May be repeated up to three times for a maximum of 16 credits.

**AFCS 5544. Seminar in Black Leadership. (4 Hours)**

Offers students an opportunity to conduct in-depth studies of significant black leaders—male and female—in a wide range of fields. Focuses on black leadership in the political arena as elected officials; leaders of pressure groups; leaders of protest organizations, black nationalist organizations, and feminist/womanist groups; and as advisers to political parties and presidential administrations.

**AFCS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

## American Sign Language (AMSL)

**AMSL 1101. Elementary ASL 1. (4 Hours)**

Introduces students to American Sign Language (ASL). Students develop expressive and receptive competence in using ASL to fulfill various social functions (such as introductions, explanations of personal history, and descriptions of simple narratives). Additional topics include the use of signing space and further use of nonmanual components including facial expression and body postures.

**AMSL 1102. Elementary ASL 2. (4 Hours)**

Continues AMSL 1101. Continues development of expressive and receptive competence in using American Sign Language to fulfill various social functions (such as introductions, explanations of personal history, and descriptions of simple narratives). Emphasizes further development of receptive and expressive skills, finger spelling, vocabulary building, grammatical structures; encourages more extensive use of nonmanual behaviors, classifiers, body postures, and signing space. Students are also introduced to regional and ethnic sign variations and political and educational institutions of the Deaf community.

**Prerequisite(s):** AMSL 1101 with a minimum grade of D-

**AMSL 1511. ASL Classifiers. (4 Hours)**

Seeks to improve understanding of and use of ASL classifiers, including appropriate nonmanual grammatical features and other nonmanual markers. Discusses classifier hand shapes and how movement, location, and orientation of classifiers affect meaning in ASL. Covers eight types of ASL classifiers: semantic, instrumental, descriptive, locative, plural, body part, sport, and elemental. Offers students an opportunity to build on existing classifier vocabulary and eventually use an expanded range of classifiers to express narratives.

**Prerequisite(s):** AMSL 1101 with a minimum grade of D-

**AMSL 1512. ASL Numbers and Fingerspelling. (4 Hours)**

Offers students an opportunity to improve receptive and expressive skills in the specific areas of ASL fingerspelling and ASL numbers. Includes a brief history of fingerspelling. Focuses on strategies for understanding fingerspelling/word phrases and number recognition; recognizing number patterns (e.g., ordinal and cardinal numbers, height, age, time); and additional strategies for understanding and using numbers and fingerspelling in context. Uses drills to improve speed, clarity, and fluency skills.

**Prerequisite(s):** AMSL 1102 with a minimum grade of C-

**AMSL 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AMSL 2101. Intermediate ASL 1. (4 Hours)**

Continues the student's development of expressive and receptive competence in using American Sign Language to fulfill various communicative functions, such as making and responding to inquiries, constructing and comprehending narratives, and engaging in debates. Students also continue to expand their ASL lexicon.

**Prerequisite(s):** AMSL 1102 with a minimum grade of C ; DEAF 1500 (may be taken concurrently) with a minimum grade of C

**AMSL 2102. Intermediate ASL 2. (4 Hours)**

Continues AMSL 2101. Emphasizes further development of receptive and expressive skills, finger spelling, vocabulary building, grammatical structures; encourages more extensive use of nonmanual behaviors, classifiers, body postures, and signing space. Continues exposure to regional and ethnic sign variations and political and educational institutions of Deaf people. Offers intensive practice involving expressive and receptive skills in storytelling and dialogue. Introduces language forms used in American Sign Language poetry and the features of culture as they are displayed in art.

**Prerequisite(s):** AMSL 2101 with a minimum grade of D-

**AMSL 2900. Specialized Instruction in ASL. (1-4 Hours)**

Designed for individuals whose language skills are at the intermediate level and who seek specially focused language instruction. Such instruction might be the use of the language in specific settings (e.g., media, medical, legal, mental health), or it might be focused on specific conversational nuances of the language. May be repeated without limit.

**AMSL 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AMSL 3101. Advanced ASL 1. (4 Hours)**

Focuses on continued development of syntactic competence in American Sign Language with particular attention to the use of ASL in formal discourse. Also focuses on lexical semantics and semantic equivalents for multiple meaning English lexical items.

**Prerequisite(s):** AMSL 2102 with a minimum grade of D-

**AMSL 3102. Advanced ASL 2. (4 Hours)**

Continues AMSL 3101. Focuses on further development and refinement of American Sign Language competence in various discourse settings, predominantly formal and consultative. Continues development of lexical semantics and uses individual diagnostic assessment of ASL competence to determine individual competency goals.

**Prerequisite(s):** AMSL 3101 with a minimum grade of D-

**AMSL 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AMSL 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AMSL 4992. Directed Study. (1-4 Hours)**

Offers students a way of going beyond work given in the regular curriculum; may also enable students to complete major requirements in certain situations. Priority is given to American Sign Language majors and to juniors and seniors. May be repeated without limit.

**AMSL 5901. Gallaudet University Program. (20 Hours)**

Offers students an opportunity to study at an officially bilingual university, with American Sign Language and English used for instruction and by the university.

## Analytics - CPS (ALY)

### ALY 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### ALY 2010. Probability Theory and Introductory Statistics. (3 Hours)

Introduces statistics for data analytics from an analysis-of-data viewpoint. Topics include frequency distributions; measures of location; mean, median, mode; measures of dispersion; variance; graphic presentation; elementary probability; populations and samples; sampling distributions; categorical data; regression and correlation; and analysis of variance. Explores the use of statistical software in data analysis. Emphasizes hands-on application of probability and statistics in SPSS.

**Prerequisite(s):** MTH 1100 with a minimum grade of D- or MTH 1200 with a minimum grade of D- or MTH 2100 with a minimum grade of D-

### ALY 2100. Introduction to Programming for Data Analytics. (3 Hours)

Offers a hands-on first programming course for those with no prior programming experience. Covers basic programming logic and syntax with Python. Students apply Python packages mostly used on data analytics. Offers students an opportunity to learn how to code on the most used language in the job market.

**Prerequisite(s):** (MTH 2400 with a minimum grade of D- or PHL 2310 with a minimum grade of D-); ITC 2300 with a minimum grade of D-

### ALY 2550. Generative AI. (3 Hours)

Presents the evolving landscape of generative AI, exploring foundational concepts, key technologies, and the mysteries inside AI's black box. Provides insights into cutting-edge models, explores platforms like ChatGPT and Claude, and studies the craft of prompt engineering to refine AI-generated results. Explores the ethical challenges of AI, addressing bias, transparency, and limitations. Offers professionals across analytics, information technology, engineering, biology, healthcare, management, business, and the humanities an opportunity to study powerful tools to make informed decisions and create impactful deliverables in an AI-driven future.

### ALY 2983. Topics. (1-4 Hours)

Discusses contemporary topics in analytics for a rotating variety of industries (nonprofit and for profit). Employs a mix of lectures, cases, and projects. Instructor determines the topics. May be repeated three times for a maximum of 16 semester hours.

### ALY 3015. Intermediate Statistics for Data Analytics. (3 Hours)

Expands upon the earlier introduced statistical approaches. Emphasizes more advanced analysis and multivariate methods. The goal is to provide students with the fundamental data management, review, reengineering, and exploration skills as necessary data analytical competencies.

**Prerequisite(s):** ALY 2010 with a minimum grade of D-

### ALY 3040. Data Mining. (3 Hours)

Introduces the theories and tools for data mining techniques such as rule-based learning, decision trees, clustering, and association-rule mining. Also covers interpretation of the mined patterns using visualization techniques. Offers students an opportunity to gain the knowledge and experience to apply modern data-mining techniques for effective large-scale data pattern recognition and insight discovery. Introduces data analysis software—student teams evaluate, analyze, and report data for the methods used and insights discovered during case studies.

**Prerequisite(s):** ALY 2100 with a minimum grade of D- ; ALY 3015 with a minimum grade of D-

### ALY 3070. Communication and Visualization for Data Analytics. (3 Hours)

Offers an interdisciplinary examination of design concepts and cognitive and communication theories that support effective practices for data visualization and communication. Considers the relationship between information and audience and studies effective techniques in the written, spoken, and visual communication of complex quantitative information. Project-based activities offer students opportunities to apply these techniques in a manner that makes data understandable, compelling, and actionable. Introduces R and Python visualization packages.

**Prerequisite(s):** ALY 2100 with a minimum grade of D- ; ALY 3015 with a minimum grade of D-

**ALY 3110. Big Data and Web Mining. (3 Hours)**

Offers students an opportunity to work with very large data sets and to learn how to write code to search the World Wide Web for publicly available data in a methodical and automated manner.

**Prerequisite(s):** ALY 2100 with a minimum grade of D- ; ALY 3015 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**ALY 3510. AI Foundations: An Interdisciplinary Approach. (3 Hours)**

Introduces artificial intelligence, serving as an excellent starting point for exploring various aspects of AI or understanding its broader societal implications. Designed to help students from all academic backgrounds understand AI's principles and applications. Examines core concepts while exploring the field's true potential and limitations. Covers various AI paradigms, including machine learning, natural language processing, computer vision, and robotics, without requiring prior programming experience. Emphasizes AI's societal impact, discussing its ethical implications, potential benefits, and challenges across different sectors. Employs hands-on projects, interactive sessions, and real-world case studies to offer a critical perspective on AI's evolving role in shaping our future.

**ALY 3983. Topics. (1-4 Hours)**

Discusses contemporary topics in analytics for a rotating variety of industries (nonprofit and for profit). Employs a mix of lectures, cases, and projects. Instructor determines the topics. May be repeated three times for a maximum of 16 semester hours.

**ALY 4000. Analytics Using R. (3 Hours)**

Offers an overview of analytics concepts and practices across a diverse range of organizational contexts. Introduces data structure and management using R and SQL R packages. Leverages big data using Hadoop, Spark, and R scripting. Engages students in discussions on analytics careers and their ethical considerations. Introduces the basics of business strategies for big data analytics through a final project.

**Prerequisite(s):** ALY 2100 with a minimum grade of D- ; ITC 2300 with a minimum grade of D-

**ALY 4020. Predictive Analytics Using R and Python. (3 Hours)**

Introduces the end-to-end data-driven predictive modeling approach in R, Python, KNIME and WEKA with applications and case studies. Includes all the data and modeling steps in a full modeling cycle (training, validation and testing), exploratory data analysis and data cleansing, commonly applied modeling techniques such as SVM, random forest and ensemble models; introduces neural networks using TensorFlow.

**Prerequisite(s):** (ALY 2100 with a minimum grade of D- ; ALY 3015 with a minimum grade of D-) or ALY 3040 with a minimum grade of D-

**ALY 4520. MLOps: Operationalizing AI. (3 Hours)**

Examines the machine learning operations, or MLOps, life cycle for designing, deploying, and managing scalable machine learning systems. Surveys emerging trends, such as serverless computing and edge deployments, to illuminate future directions in MLOps. Highlights foundational methods for data ingestion, pipeline orchestration, and performance monitoring while addressing ethical and security considerations. Emphasizes cross-functional collaboration between data science and engineering for production-ready solutions that prioritize reliability and reproducibility. Demonstrates how automation strategies and best practices accelerate feedback loops and streamline model updates. Encourages a practice-based approach that integrates experimental results with continuous delivery to align with organizational goals.

**Prerequisite(s):** ALY 4020 with a minimum grade of B

**ALY 4570. Social Impacts and Issues of AI. (3 Hours)**

Presents a comprehensive overview of AI's fundamental concepts, techniques, and applications. Addresses core components—such as problem-solving and search algorithms, knowledge representation and reasoning, machine learning principles and algorithms, computer vision, and natural language processing—while highlighting practical considerations, ethical issues, and the societal implications of AI. Reinforces understanding and aims to develop practical skills through hands-on programming assignments and projects in Python. Offers students an opportunity to establish a solid foundation for mastering AI principles and techniques, preparing them for further study or careers in the field.

**Prerequisite(s):** ALY 2100 with a minimum grade of D-

**ALY 4850. Analytics Capstone. (3 Hours)**

Offers an advanced practicum in the development and delivery of data analysis for strategic decision making in organizations. Students apply the principles and tools of analytics to a comprehensive real-world problem or project within a sponsoring organization. Expects students to present analytical insights and recommendations for successful implementation of their capstone project.

**Prerequisite(s):** ALY 3040 with a minimum grade of D- ; ALY 3070 with a minimum grade of D- ; ALY 4000 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**ALY 4955. Project. (1-4 Hours)**

Focuses on an in-depth project where the student conducts research or creates a product related to their major field. May be repeated twice for a maximum of 12 semester hours.

**ALY 4983. Topics. (1-4 Hours)**

Discusses contemporary topics in analytics for a rotating variety of industries (nonprofit and for profit). Employs a mix of lectures, cases, and projects. Instructor determines the topics. May be repeated three times for a maximum of 16 semester hours.

**ALY 5000. Introduction to Analytics. (2.25 Hours)**

Offers an overview of analytics concepts and practices across a diverse range of industries and organizational contexts. Provides a hands-on introduction to statistics, data management, and the R scripting language. Technical projects based on introductory statistics and the R language offer students an opportunity to understand and apply the theories, practices, and application of analytics to real-world problems. An initial exploration of data sets illustrates how fundamental data analysis can impact decision making at both the strategic and operational level. Students research case studies to examine careers and professional opportunities in both for-profit and nonprofit industry segments.

**ALY 5010. Probability Theory and Introductory Statistics. (2.25 Hours)**

Introduces statistics for business analytics from an analysis-of-data viewpoint. Topics include frequency distributions; measures of location; mean, median, mode; measures of dispersion, variance, graphic presentation; elementary probability; populations and samples; sampling distributions; and categorical data. Includes a preliminary introduction to regression and correlation. Uses statistical software (for data analysis during analytic project assignments) to provide a hands-on experience to observe how probability and statistics, scripting, and basic data management impact decision making at all levels within a corporation.

**ALY 5015. Intermediate Analytics. (2.25 Hours)**

Builds on the foundation provided in ALY 6000 and ALY 6010 by exploring at greater depth the tools of data correction and recoding, as well as those of statistics and R. Offers students an opportunity to learn to discern and validate meaningful and statistically significant patterns in data through sound applications of the scientific method. Emphasizes initial mastery of correlation and regression, ANOVA, GLM, and logistic regression. Introduces the more advanced techniques of multivariable regression and nonparametric statistics and sampling. The goal of this course is to offer students an opportunity to master the fundamental skills of data management, analysis, and communication, which are the core data analytical competencies required of today's analytic professionals.

**ALY 5030. Data Warehousing and SQL. (2.25 Hours)**

Focuses on the management, mining, and interpretation of patterns in large databases. Offers students an opportunity to learn how organizations construct data warehouses from operational databases, about different data warehouse architectures, how to build a data warehouse, and how to structure databases for efficient data mining. Discusses relational databases and Structured Query Language (SQL) for the fundamentals in data modeling, database management, and SQL queries. Introduces other modern database systems such as NoSQL (non SQL) and column-based databases.

**ALY 5050. Introduction to Enterprise Analytics. (2.25 Hours)**

Introduces advanced specific analysis techniques—including forecasting, simulation, linear programming, regressive modeling, and optimization—as well as the Python programming language. The more advanced mathematical, statistical, and presentation functions within the R library packages are heavily utilized. Emphasizes enterprise data analytics, which is the extensive use of data, statistical, and quantitative analysis; exploratory and predictive models; and fact-based decision making to drive business strategies and actions. Course projects embrace marketing, retail, financial, and human resources analytics, as well as familiarize students with general industry practices. Emphasizes end-to-end analytic development skills, including data management, data engineering, analytics modeling, and strategy development. Offers students hands-on opportunities to apply quantitative techniques in strategic business decision making.

**ALY 5070. Communication and Visualization for Data Analytics. (2.25 Hours)**

Offers an interdisciplinary examination of design concepts and cognitive and communication theories that support effective practices for data visualization and communication. Considers the relationship between information and audience and studies effective techniques in the written, spoken, and visual communication of complex quantitative information. Project-based activities offer students opportunities to apply these techniques in a manner that makes data understandable, compelling, and actionable. Introduces R Shiny, Tableau and R in the lab sessions as the tool for data visualization.

**ALY 5110. Data Management and Big Data. (2.25 Hours)**

Designed to provide the student with the core concepts of data collection and management. Topics include systems for collecting data and implications for practice; types of data (textual, quantitative, qualitative, etc.); and storing data with privacy and security issues in mind. Offers students an opportunity to obtain a high-level understanding of big data technologies for data accessibility, efficiency, and security of data management at scale, including big data storage and computing technologies and big data analytics applications. Students create a working system for data acquisition and management using publicly available data sets and evaluate traditional data warehouse platforms as well as cloud-based big data storage and computing technologies. Azure is also introduced and used in the lab sessions.

**ALY 6000. Introduction to Analytics. (3 Hours)**

Offers an overview of analytics concepts and practices across a diverse range of industries and organizational contexts. Provides a hands-on introduction to statistics, data management, and the R scripting language. Technical projects based on introductory statistics and the R language offer students an opportunity to understand and apply the theories, practices, and application of analytics to real-world problems. An initial exploration of data sets illustrates how fundamental data analysis can impact decision making at both the strategic and operational level. Students research case studies to examine careers and professional opportunities in both for-profit and nonprofit industry segments.

**ALY 6010. Probability Theory and Introductory Statistics. (3 Hours)**

Introduces statistics for business analytics from an analysis-of-data viewpoint. Topics include frequency distributions; measures of location; mean, median, mode; measures of dispersion, variance, graphic presentation; elementary probability; populations and samples; sampling distributions; and categorical data. Includes a preliminary introduction to regression and correlation. Uses statistical software (for data analysis during analytic project assignments) to provide a hands-on experience to observe how probability and statistics, scripting, and basic data management impact decision making at all levels within a corporation.

**Prerequisite(s):** ALY 6000 (may be taken concurrently) with a minimum grade of C-

**ALY 6015. Intermediate Analytics. (3 Hours)**

Builds on the foundation provided in ALY 6000 and ALY 6010 by exploring at greater depth the tools of data correction and recoding, as well as those of statistics and R. Offers students an opportunity to learn to discern and validate meaningful and statistically significant patterns in data through sound applications of the scientific method. Emphasizes initial mastery of correlation and regression, ANOVA, GLM, and logistic regression. Introduces the more advanced techniques of multivariable regression and nonparametric statistics and sampling. The goal of this course is to offer students an opportunity to master the fundamental skills of data management, analysis, and communication, which are the core data analytical competencies required of today's analytic professionals.

**Prerequisite(s):** ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C-

**ALY 6020. Predictive Analytics. (3 Hours)**

Introduces the end-to-end, data-driven statistical and predictive modeling approach with applications and case studies. Includes all the data and modeling steps in a full modeling cycle, including data ETL process, exploratory data analysis, and data cleansing for outlier imputation and data normalization. Commonly applied modeling techniques such as k-nearest neighbors, GLM, random forest, neural networks, and Naive Bayes are heavily utilized and explained using advanced visualization techniques and simplified mathematical derivations to enhance understanding. Predictive analytic modeling steps such as model training, validation, and testing are widely utilized, as are tools and languages for data processing, analysis, and modeling.

**Prerequisite(s):** ALY 6015 with a minimum grade of C- ; ALY 6070 with a minimum grade of C-

**ALY 6030. Data Warehousing and SQL. (3 Hours)**

Focuses on the management, mining, and interpretation of patterns in large databases. Offers students an opportunity to learn how organizations construct data warehouses from operational databases, about different data warehouse architectures, how to build a data warehouse, and how to structure databases for efficient data mining. Discusses relational databases and Structured Query Language (SQL) for the fundamentals in data modeling, database management, and SQL queries. Introduces other modern database systems such as NoSQL (non SQL) and column-based databases.

**Prerequisite(s):** ALY 6000 with a minimum grade of C- ; ALY 6015 with a minimum grade of C-

**ALY 6040. Data Mining Applications. (3 Hours)**

Introduces the theories and tools for intensive data analysis methods and data mining techniques such as rule-based learning, decision trees, clustering, and association-rule mining. Also covers interpretation of the mined patterns using visualization techniques. Offers students an opportunity to gain the knowledge and experience to apply modern data-mining techniques for effective large-scale data pattern recognition and insight discovery. Introduces data analysis software; student teams evaluate, analyze, and report data for the methods used and insights discovered during case studies.

**Prerequisite(s):** (ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C- ) or (EAI 6000 with a minimum grade of C- ; EAI 6010 with a minimum grade of C- )

**ALY 6050. Introduction to Enterprise Analytics. (3 Hours)**

Introduces advanced specific analysis techniques—including forecasting, simulation, linear programming, regressive modeling, and optimization—as well as the Python programming language. The more advanced mathematical, statistical, and presentation functions within the R library packages are heavily utilized. Emphasizes enterprise data analytics, which is the extensive use of data, statistical, and quantitative analysis; exploratory and predictive models; and fact-based decision making to drive business strategies and actions. Course projects embrace marketing, retail, financial, and human resources analytics, as well as familiarize students with general industry practices. Emphasizes end-to-end analytic development skills, including data management, data engineering, analytics modeling, and strategy development. Offers students hands-on opportunities to apply quantitative techniques in strategic business decision making.

**Prerequisite(s):** ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C-

**ALY 6060. Decision Support and Business Intelligence. (3 Hours)**

Introduces current and emerging business analytical concepts and information technologies to support decision making and business intelligence. Commercial decision support systems in various application areas are introduced and discussed using case studies, including CRM (customer relationship management) for customer management, web analytics applications, sales force management systems, etc. Introduces business intelligence technology and applications, such as OLAP (Online Analytical Processing), OBIEE (Oracle Business Intelligence Enterprise Edition), and IBM Cognos. Offers students an opportunity to gain hands-on experience using business intelligence tools, including Tableau or QlikView.

**ALY 6070. Communication and Visualization for Data Analytics. (3 Hours)**

Offers an interdisciplinary examination of design concepts and cognitive and communication theories that support effective practices for data visualization and communication. Considers the relationship between information and audience and studies effective techniques in the written, spoken, and visual communication of complex quantitative information. Project-based activities offer students opportunities to apply these techniques in a manner that makes data understandable, compelling, and actionable. Introduces R Shiny, Tableau and R in the lab sessions as the tool for data visualization.

**Prerequisite(s):** ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C-

**ALY 6080. Integrated Experiential Learning. (3 Hours)**

Offers a practicum in the development and delivery of predictive data analysis for strategic decision making in organizations. Offers students an opportunity to apply the principles and tools of analytics to real-world problems in business organizations and to develop and present analytical insights and recommendations for successful implementation of their capstone project.

**Prerequisite(s):** ALY 6015 with a minimum grade of C- ; ALY 6050 with a minimum grade of C- ; ALY 6070 with a minimum grade of C-

**ALY 6110. Data Management and Big Data. (3 Hours)**

Designed to provide the student with the core concepts of data collection and management. Topics include systems for collecting data and implications for practice; types of data (textual, quantitative, qualitative, etc.); and storing data with privacy and security issues in mind. Offers students an opportunity to obtain a high-level understanding of big data technologies for data accessibility, efficiency, and security of data management at scale, including big data storage and computing technologies and big data analytics applications. Students create a working system for data acquisition and management using publicly available data sets and evaluate traditional data warehouse platforms as well as cloud-based big data storage and computing technologies. Azure is also introduced and used in the lab sessions.

**Prerequisite(s):** (ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C- ) or (EAI 6000 with a minimum grade of C- ; EAI 6010 with a minimum grade of C- )

**ALY 6120. Leadership in Analytics. (3 Hours)**

Covers analytical leadership principles for the structure and dynamics of organizations, combining relevant research to offer students an opportunity to deepen their understanding of effective change in business analytical decision making.

**ALY 6130. Risk Management for Analytics. (3 Hours)**

Seeks to provide a conceptual overview of analytic risk management. Offers students an opportunity to evaluate and analyze financial, technical, and other business risk-assessment and risk-modeling techniques and tools.

**ALY 6140. Python and Analytics Systems Technology. (3 Hours)**

Presents a selection of analytics systems technologies that are deployed in lab sessions throughout the course. A multitude of analytics systems technologies are used for different purposes to describe data numerically and graphically, for data visualization, file systems (HFS) for a large data mart, applications of structured query language, and filtering and transforming to ingest the data through scripting languages. Focused primarily on Python, topics covered include the differences between R and Python, data ingestion, data manipulation, visualization, and predictive analytics using common Python libraries.

**ALY 6150. Healthcare/Pharmaceutical Data and Applications. (3 Hours)**

Introduces a selection of healthcare/pharmaceutical data used for a variety of purposes, and its specific application in data-driven business decision making. Healthcare/Pharmaceutical data is collected as part of Medicare and Medicaid databases and as mandated by the PPACA (Patient and Affordable Care Act) and the PPSA (Physicians Payment Sunshine Act). Data is available in the form of medical records, social networks, outcomes databases, syndicated data reports, epidemiological data, demographic data, analyst information, RD Pipeline Database, market data, and online journals and newsletters. Organizations, corporations, and companies use these varieties of data for a host of different reasons - to better profile and segment customers, to answer performance questions, and to identify and capture key opportunities.

**Prerequisite(s):** (ALY 6000 (may be taken concurrently) with a minimum grade of C- ; ALY 6010 with a minimum grade of C- ) or (EAI 6000 with a minimum grade of C- ; EAI 6010 with a minimum grade of C- )

**ALY 6980. Capstone. (3 Hours)**

Offers an advanced practicum in the development and delivery of predictive data analysis for strategic decision making in organizations. Students apply the principles and tools of analytics to a comprehensive real-world problem or project within a sponsoring organization. Expects students to present analytical insights and recommendations for successful implementation of their capstone project and their individual project proposal.

**Prerequisite(s):** ALY 6080 with a minimum grade of C- ; ALY 6040 with a minimum grade of C- ; ((ALY 6110 with a minimum grade of C- ; ALY 6020 with a minimum grade of C- ) or (ALY 6060 with a minimum grade of C- ; ALY 6120 with a minimum grade of C- ) or (EAI 6000 with a minimum grade of C- ; EAI 6010 with a minimum grade of C- )); ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C- ; ALY 6015 with a minimum grade of C- ; ALY 6050 with a minimum grade of C- ; ALY 6070 with a minimum grade of C-

**ALY 6983. Topics. (3 Hours)**

Discusses contemporary topics in analytics for a rotating variety of industries (nonprofit and for-profit).

**Prerequisite(s):** ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C-

**ALY 6995. Project. (1-4 Hours)**

Focuses on an in-depth project in which a student conducts research or produces a product related to the student's major field.

**Anthropology (ANTH)****ANTH 1000. Anthropology at Northeastern. (1 Hour)**

Intended for first-year students in the College of Social Sciences and Humanities. Introduces students to liberal arts; familiarizes them with their major; develops the academic skills necessary to succeed (analytical ability and critical thinking); provides grounding in the culture and values of the University community; and helps to develop interpersonal skills—in short, familiarizes students with all skills needed to become a successful university student.

**ANTH 1101. Peoples and Cultures. (4 Hours)**

Surveys basic concepts in cultural anthropology by looking at a range of societies and the issues they face in a globalizing world. Examines the manner in which cultures adapt to, reject, or modify all of the changes they face. These changes impact everything from traditional family structure, to religion, gender, all the way to patterns of joking and concepts of beauty the world over.

**Attribute(s):** NUpath Interpreting Culture

**ANTH 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ANTH 2302. Gender and Sexuality: A Cross-Cultural Perspective. (4 Hours)**

Explores concepts of "sex" and "gender" in a cross-cultural framework as they pertain to social status, work, the body, intersexuality, third or alternative genders, and intersectionality. Problematizes normative assumptions about femininity and masculinity; the relations between men and women; and the meanings and implications of being a woman, man, or an other-gendered person. Examines how social constructions of gender contribute and interact with other systems of categorization and structures of inequality such as race, class, and ethnicity.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or SOCL 1101 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**ANTH 2305. Global Markets and Local Culture. (4 Hours)**

Examines selected topics in the socioeconomic transformation of other cultures, including urbanization, industrialization, globalization, commodity production, and international labor migration. Focuses on the impact of global capitalist development on contemporary developing and postcolonial societies as well as local responses and/or resistances to those changes.

**Attribute(s):** NUpath Interpreting Culture

**ANTH 2315. Religion and Modernity. (4 Hours)**

Introduces a cross-cultural, comparative perspective on religious practice and belief. Explores theoretical definitions of and methodological approaches to the study of religion, as well as more specific concepts of ritual, myth, healing, and identity. Select case studies allow for an in-depth look at the unique formations of a few religious practices and groups.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**ANTH 2485. Environment, Technology, and Society. (4 Hours)**

Focuses on the connections between the development of modern nation-states and the control of nature. Explores the role human societies play in such events as climate change, tsunamis, and droughts. Studies how industrialization and the process of science and technology development are related to our transforming environmental conditions, as well as how the social sciences, the sciences, and engineering are transforming to address these issues. Draws on social theory, environmental history, anthropology, sociology, art, design, and open-source technologies to investigate theoretically and methodologically the sources, experiences of, and solutions for environmental health questions.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D- or SOCL 1246 with a minimum grade of D- or WMNS 1103 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**ANTH 2800. Museum Anthropology. (4 Hours)**

Covers, in critical depth, the political and socio-cultural formation, development, and elaboration of the modern museum and the arguments to which it has recently given rise, with a focus on collections in the Age of Empire and after. Draws on interdisciplinary approaches to the study of museums and heritage to explore institutional practices and their connections to nationalism, empire, coloniality, anticolonial struggles, and, most recently, decolonization. Topics include the ethics of collecting, the politics of display, colonial looting, ongoing debates about repatriation, and the role of AI in immersive exhibits.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or SOCL 1101 with a minimum grade of D-

**Attribute(s):** NUpath Integration Experience

**ANTH 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ANTH 2991. Research Practicum. (2-4 Hours)**

Involves students in collaborative research under the supervision of a faculty member. Offers students an opportunity to learn basic research methods in the discipline. Requires permission of instructor. May be repeated once for up to 4 total credits.

**ANTH 3100. Gender, Social Justice, and Transnational Activism. (4 Hours)**

Introduces key issues, themes, and debates in feminist transnational theory, practice, and activism in contemporary contexts and how it has changed under socioeconomic, political, and cultural processes of globalization. Examines differences among women relating to race, class, sexuality, national identity, and political economy in reckoning with possibilities for sustainable social justice. Students interrogate the relationship between the local and global; the production of knowledge in different regional spaces; the pragmatics of political mobilization; the varying contours of "social justice"; and other key issues. Offers students an opportunity to discuss the impact of globalization, neoliberalism, and state and intimate violence on gendered politics and relations and to contend with the politics of difference, to debate its challenges, and to imagine possible futures for transnational gender justice.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**ANTH 3200. Cities in Global Context. (4 Hours)**

Examines the roots of the urbanization process, major ways of thinking about it, and the development of world cities and megacities. The twenty-first century will be a century in which urbanism is a central problem and opportunity. Considers the economic, political, cultural, and environmental dimensions of urbanism across the globe. Includes specific case studies from around the world. Encourages students to develop a knowledge of particular cities in order to examine the key themes of the course. INTL 3200, ANTH 3200, and SOCL 3200 are cross-listed.

**ANTH 3410. Ethnographic Field Experience. (4 Hours)**

Offers students an opportunity to experience fieldwork while studying current ethnographic methods and theory and to design a semester-long ethnographic field research project. Field sites may include public and outdoor spaces, online communities, cultural centers, schools, immigrant neighborhoods, sports organizations, social service agencies, nonprofit groups, religious institutions, etc.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Integration Experience

**ANTH 3417. Political Anthropology. (4 Hours)**

Examines the anthropology of politics, focusing on the anthropology of the state. Studies the history of political anthropology with its roots in British structural-formalism and contextualizes it within the anthropology of Africa and witchcraft. Explores the linkages between the nation and the state, using classic works of Benedict Anderson on nationalism, before commencing an in-depth study of the problems of the state, classical theories of the state and statecraft, and how these ideas are traced to contemporary ethnographies of politics. Students interested in the study of resistance, displacement, social exclusion, citizenship, state violence, and communities may find this course relevant to their interests.

**Prerequisite(s):** SOCL 1101 with a minimum grade of D- or ANTH 1101 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions, NUpath Writing Intensive

**ANTH 3418. Wired/Unwired: Cybercultures and Technopolitics. (4 Hours)**

Explores the impacts of technology and new media on politics, society, and culture. Emphasizes the socioeconomic and political frameworks within which technologies are embedded as well as the role of technology and the Internet in contemporary political and cultural movements. Topics may include the political and cultural effects of the census, the radio, and the camera; the history of the Internet; virtual worlds and communities; online politics and activism; as well as blogging, gaming, and social networking.

**Prerequisite(s):** SOCL 1101 with a minimum grade of D- or ANTH 1101 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**Attribute(s):** NUpath Interpreting Culture

**ANTH 3421. Foundations of Anthropological Theory. (4 Hours)**

Introduces the foundations of anthropological theory. Examines recurring themes surrounding structure and agency, culture and power, and the tension between the individual and society. Addresses these questions by returning to anthropology's Enlightenment roots, early evolutionary thought, classic and contemporary theories, as well as ongoing critiques of the discipline. Explores different schools of thought, including functionalism, structural functionalism, symbolism, interpretivism, and more recent theoretical developments that address history, political economy, reflexivity, poststructuralism, and feminism, as well as transnational/global and activist approaches.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D-

**Attribute(s):** NUpath Writing Intensive

**ANTH 3441. Medical Anthropology. (4 Hours)**

Examines core concepts of medicine as a cultural system, then moves to anthropology of the body as it has been understood and shaped within healing systems. Medical anthropology is a subfield of anthropology that uses the four-field approach to examine cultural concepts and experiences of health, illness, treatment, and power cross-culturally. Emphasizes history and construction of biomedicine. Surveys traditional Chinese medicine, Ayurvedic medicine, Voudon, Mayan curanderos, and other folk healing systems around the world. Explores medical pluralism, the common practice of seeking out and utilizing more than one therapeutic treatment style at one time; structural violence; and how healing systems interact with broader political and social systems globally.

**Prerequisite(s):** ANTH 1101 with a minimum grade of C or SOCL 1101 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**ANTH 3442. Anthropology of Law. (4 Hours)**

Examines the institutions, history, and practices of modern law, including the contradictions of liberal law, its co-emergence with narratives of "the primitive" and "the civilized", its relationship to Christianity and science, and its most pervasive myths and cultural assumptions. No prior knowledge of law is required.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or SOCL 1101 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**ANTH 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ANTH 4100. Making Anthropology Public. (4 Hours)**

Reflects on the social, economic, ecological, and cultural value of anthropology as a field, as well as an experiential learning space for transforming anthropological research into material understandable by the general public. Offers students an opportunity to learn methodologies across visual, collaborative, and engaged anthropologies, as well as to study the ethical considerations and specific skills necessary to communicate effectively in a variety of modalities.

**Prerequisite(s):** ANTH 1101 with a minimum grade of B-

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov, NUpath Integration Experience

**ANTH 4200. Anthropology of Rural America. (4 Hours)**

Considers how rural areas are socially, geographically, and culturally constructed by political, social, and racialized forces through both isolationist and extractive practices. Confronts rurality as a political image, showing how it takes on both meanings of belonging and otherness depending on its context and usage. Explores the theoretical concept of rurality and its relationship to colonialism; regional case studies; and intersectional issues of gender, sexuality, race, class, and social inequality. Offers students an opportunity to explore essential topics in and related to the anthropology of rural studies.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D-

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**ANTH 4210. Anthropology of Eastern Europe. (4 Hours)**

Explores the societies, cultures, and politics of Eastern Europe, focusing on social upheaval and cultural change after the fall of state socialism. Examines themes including capitalist transition, European integration, ethnic and religious conflict, nation-building, and state contestation, maintaining a focus on the everyday realities of Eastern Europeans. Covers key theoretical debates about East-West geopolitical polarity, drawing on decolonial and postcolonial perspectives to challenge representations of Eastern Europe as transitional, peripheral, or backwards.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**ANTH 4220. South Asian Diasporas. (4 Hours)**

Seeks to provide an understanding of South Asians as one of the largest migrant communities globally, coming from India, Pakistan, Bangladesh, Nepal, Myanmar, Bhutan, and Sri Lanka. Concentrates on the diaspora as a heterogeneous group comprising multiple nationalities, religions, castes, classes, languages, and genders. Examines the history, opportunities, and challenges of South Asian mobility and migration. Draws from texts in sociocultural anthropology, Asian American studies, history, and transnational feminist studies to trace the emergence of a new global regime on migration and citizenship through the unprecedented mobility of South Asians in the 20th and 21st centuries.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions, NUpath Writing Intensive

**ANTH 4350. Ethnography of Southeast Asia. (4 Hours)**

Offers a seminar on the societies and cultures of Southeast Asia. Uses an interdisciplinary approach to this diverse and dynamic geopolitical region, with readings from anthropology, history, political science, and literature. Covers the major political and cultural changes that have shaped Southeast Asia in relation to the world—from the age of colonial expansion, to the rise of nation-states, to the present global era. Examines central questions in the ethnography of Southeast Asia, emphasizing the postcolonial legacies of Southeast Asia, states and violence, culture and mobility, and pressing contemporary issues in globalizing Southeast Asia. ANTH 4350 and INTL 4350 are cross-listed.

**Prerequisite(s):** SOCL 1101 with a minimum grade of D- or ANTH 1101 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions, NUpath Writing Intensive

**ANTH 4410. Neoliberalism in Asia. (4 Hours)**

Introduces key definitions and theories of neoliberalism and situates these ideas through Asian experiences of neoliberalism. Emphasizes the relationship between neoliberal processes and state-led development, as well as the relationship between neoliberal thought and bottom-up societal changes. Combines films, theoretical readings, and ethnography to explore hallmarks of anthropological analyses of neoliberalism in debates over cultural agency, locality, values, and politics in East, South, and Southeast Asian countries. Critically examines topics such as English-language dominance in the Asian region, the rise of plastic surgery, youth unemployment and political consciousness, and real estate speculation in Asian megacities.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**ANTH 4500. Latin American Society and Development. (4 Hours)**

Explores the processes of social, economic, and cultural change in Latin America. While concentrating on the present, traces class formation, agrarian structures, ethnic identity, ceremonial organization, gender roles, and political conflict since the colonial era in a range of countries. Emphasizes the relationship of communities and national political and economic systems. May emphasize Central America and Mexico or countries in South America through case studies. ANTH 4500 and INTL 4500 are cross-listed.

**Prerequisite(s):** (SOCL 1101 with a minimum grade of D- or ANTH 1101 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D-); (ENGL 1111 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1102 with a minimum grade of C)

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**ANTH 4510. Contemporary Issues in Global Africa. (4 Hours)**

Explores Africa's changing place in the world. Studies the history of Africa and explores the role of ethnography in the making of colonial Africa and the cultural transformations and continuities produced by the emergence of African cities during and after colonialism. Studies postcolonial Africa to critically and comparatively engage with contemporary issues facing African societies. Considers the efflorescence of new cultural forms of music, art, film, and literature, in conjunction with new sources of identity such as nationality, religion, ethnicity, consumption, and migration.

**Prerequisite(s):** (ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D-); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C)

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**ANTH 4515. Culture and Politics in Modern India. (4 Hours)**

Introduces the histories, cultures, and peoples of India. Seeks to convey a sense of how knowledge has been constructed about the region and how the subcontinent has been shaped by its engagements with the world through such processes as colonization, state building, and globalization. Uses readings, films, and class discussions to examine themes and topics that include Orientalism, postcolonialism, caste and community, gender and sexualities, conflict and violence, development and resistance, and transnational structures and processes. Critically evaluates some commonly held assumptions including classical understandings of tradition and modernity, cohesion and conflict, and nation and identity. ANTH 4515 and INTL 4515 are cross-listed.

**Prerequisite(s):** SOCL 1101 with a minimum grade of D- or ANTH 1101 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions, NUpath Writing Intensive

**ANTH 4520. Chinese Society and Culture. (4 Hours)**

Introduces students to changes in society and economy in contemporary China. Examines changes in family, gender relations, rural life, work, and international relations. Draws on literature from a range of disciplines including sociology, political science, anthropology, and economics.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**ANTH 4580. Special Topics in Anthropology. (4 Hours)**

Designed as a specialized themes course for students with prior experience in anthropology and/or sociology. Offers unique opportunities—visiting guests, special thematic interests—which are not part of the regular curriculum. May be repeated without limit.

**ANTH 4600. Senior Seminar. (4 Hours)**

Designed to deal with anthropological theory and work with students who are asked to apply these theories to some of their own work. Content may vary.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**ANTH 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**ANTH 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated once.

**Prerequisite(s):** ANTH 4970 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience

**ANTH 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ANTH 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**ANTH 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

## Anthropology - CPS (ANT)

### **ANT 1150. Cultural Anthropology. (3 Hours)**

Investigates the field of cultural anthropology. Covers a range of societies in terms of such sociocultural institutions as kinship, gender relations, economics, politics, and religion. Examines important political and economic processes, such as colonialism and development, affecting cultures around the world.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

### **ANT 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **ANT 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **ANT 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **ANT 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

### **ANT 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Applied Artificial Intelligence - CPS (AAI)

### **AAI 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

### **AAI 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

### **AAI 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

### **AAI 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

### **AAI 5015. Mathematical Concepts. (3 Hours)**

Reviews the mathematical knowledge required to succeed in advanced artificial intelligence studies. Covers a wide range of mathematical concepts including introductory linear algebra, probability, statistics, and calculus. Beginning with basic linear algebra, introduces vectors, matrices, and linear transformations, which are crucial in understanding data representations and transformations in AI algorithms. Continues with probability and statistics, equipping students with the tools to analyze data, make predictions, and understand uncertainties in applied machine learning. Covers the essentials of calculus, which are fundamental to understanding optimization problems in AI algorithms.

**AAI 5025. Python. (3 Hours)**

Studies foundational programming and its significance in artificial intelligence applications, recognizing AI's growing influence in various fields. Emphasizes essential programming skills related to data structures and object-oriented programming, the skills crucial for efficiently implementing the applied machine-learning models. Offers students an opportunity to obtain the software skills necessary for conducting fundamental statistical analyses, predictive modeling, and data visualization.

**AAI 5035. Research Methods and Scientific Writing. (3 Hours)**

Examines the research methodologies and scientific writing techniques specific to the field of artificial intelligence. Offers students experience conducting, writing, and critically evaluating AI research, to discern groundbreaking studies from less impactful studies. Topics include a diverse array of research methodologies designed for AI and evaluation of the most appropriate methods aligned with student research questions. Reviews the processes of drafting research papers, including writing abstracts, literature reviews, methodologies, results, and discussions tailored to the AI community.

**AAI 6600. Applied Artificial Intelligence. (3 Hours)**

Introduces artificial intelligence, tracing its historical evolution and foundational principles. Delves into search algorithms for problem solving, knowledge representation, reasoning, planning, and decision making. Also covers probabilistic learning and the foundational aspects of machine learning. Emphasizes real-world applications to offer students an opportunity to obtain an in-depth understanding of AI's transformative potential, paving the way for more advanced studies in the field.

**AAI 6610. Applied Machine Learning. (3 Hours)**

Analyzes machine learning techniques, methodologies, and best practices tailored for advanced artificial intelligence applications. Covers advanced supervised and unsupervised learning, deep learning architectures, reinforcement learning, and domain-specific applications. Explores crucial topics of ethics, privacy, and fairness in machine learning.

**AAI 6620. Applied Natural Language Processing. (3 Hours)**

Provides hands-on instruction in natural language processing designed for applied AI. Offers students an opportunity to obtain real-world experience in crafting and refining NLP solutions in a project-based format and solving challenges that mirror industry and research scenarios. Emphasizes applied projects over pure theory.

**Prerequisite(s):** AAI 6610 with a minimum grade of C-

**AAI 6630. Applied Computer Vision. (3 Hours)**

Offers practical exposure to the field of computer vision. Explores deeply the essential techniques, tools, and uses of computer vision and applies them to real-world situations.

**Prerequisite(s):** AAI 6610 with a minimum grade of C-

**AAI 6640. Applied Deep Learning. (3 Hours)**

Offers an advanced exploration of the theoretical foundations, architectures, and techniques essential for the design and optimization of deep learning models. Broadly discusses convolutional and recurrent neural networks, attention mechanisms, generative models, and transformer networks. Offers hands-on experience in implementing, optimizing, and deploying deep learning solutions to real-world problems. Highlights current challenges and the latest trends in the field.

**AAI 6650. Recommender System. (3 Hours)**

Designed to provide a comprehensive understanding of recommender systems and hands-on experience in building personalized recommendation engines. Examines the fundamental concepts of recommendation algorithms, data preprocessing, model evaluation, and deployment strategies. Offers real-world projects, offering the opportunity to create effective and scalable recommendation systems catering to diverse application domains.

**AAI 6655. Prompt Engineering. (3 Hours)**

Provides instruction in essential knowledge and skills for prompt engineering in artificial intelligence and machine learning contexts. Studies effective communication with AI models, prompt design for diverse applications, and the evaluation and enhancement of AI outputs. Combines theory with practical exercises to enable application of prompt engineering techniques effectively in real-world situations.

**Prerequisite(s):** AAI 6600 with a minimum grade of C-

**AAI 6660. Chatbot Architecture. (3 Hours)**

Introduces the world of conversational artificial intelligence and chatbots. Blends theoretical concepts with practical hands-on projects to understand the foundations of chatbot development and deployment, examine tools and techniques, and implement chatbot solutions personalized for diverse industries.

**Prerequisite(s):** AAI 6600 with a minimum grade of C- ; AAI 6610 with a minimum grade of C-

**AAI 6665. Generative Artificial Intelligence. (3 Hours)**

Provides a fundamental introduction to generative artificial intelligence, integrating theoretical concepts with hands-on skills in this emerging field. Aims to empower students to grasp, value, and utilize the capabilities of generative AI in practical scenarios, with a strong focus on real-life applications. Highlights the versatility of generative AI in numerous areas.

**Prerequisite(s):** AAI 6600 with a minimum grade of C- ; AAI 6610 with a minimum grade of C- ; AAI 6620 with a minimum grade of C- ; AAI 6630 with a minimum grade of C- ; AAI 6640 with a minimum grade of C-

**AAI 6670. Chatbot Application. (3 Hours)**

Explores chatbots powered by artificial intelligence. Chatbots have become crucial in improving user interactions and streamlining operations in the fast-changing digital world. Begins with basic concepts and transitions to practical chatbot development, attempting real industry challenges.

**Prerequisite(s):** AAI 6600 with a minimum grade of C-

**AAI 6680. AI for Cybersecurity. (3 Hours)**

Offers a distinct viewpoint on utilizing advanced artificial intelligence methods in cybersecurity by promoting a deep understanding of AI in cybersecurity and encouraging research to improve security solutions in this critical field. Examines AI principles and approaches while directly tackling the persistent issues in the cybersecurity domain. Offers students an opportunity to obtain both theoretical knowledge and to develop practical expertise by implementing AI techniques in real-world cybersecurity scenarios. Explores research opportunities in cybersecurity to enhance security solutions and tackle emerging threats.

**Prerequisite(s):** AAI 6620 with a minimum grade of C- ; AAI 6630 with a minimum grade of C-

**AAI 6690. Machine Learning for Cyberdetection. (3 Hours)**

Applies machine learning techniques to solve complex cybersecurity problems. Explores threat detection, malware classification, and network security by leveraging the power of data-driven decisions.

**Prerequisite(s):** AAI 6680 with a minimum grade of C-

**AAI 6710. Graph Signal Processing. (3 Hours)**

Introduces the interdisciplinary field of graph signal processing and its pivotal role in 3D imaging. Begins with foundational concepts in graph theory and graph signals, progressing to their applications in 3D imaging. Explores specific fundamental machine learning applications of graph signal processing. Offers students an opportunity to acquire the skills to implement graph signal processing methods for various AI-driven applications.

**Prerequisite(s):** AAI 6600 with a minimum grade of C- ; AAI 6610 with a minimum grade of C-

**AAI 6720. Graph Neural Networks. (3 Hours)**

Explores graph neural networks, which have emerged as a powerful tool for machine learning on irregular structures, enabling novel applications across diverse fields within AI. Topics include essential neural network concepts, traditional neural networks' limitations when handling irregularly structured data, theoretical foundations, and practical applications of GNNs. Also covers advanced GNN architectures, generative models, dynamic graph networks, and transferability. Studies spectral-based and spatial-based GNN methods and evaluates models for various tasks through lectures, readings, assignments, and hands-on projects.

**Prerequisite(s):** AAI 6710 with a minimum grade of C-

**AAI 6730. Deep Learning for 3D Point Cloud Analysis. (3 Hours)**

Offers an in-depth exploration of graph neural networks for processing 3D point cloud data across various artificial intelligence fields. Beginning with the fundamentals of 3D point clouds and neural networks for 2D structures, transitions to the concepts of GNNs for 3D point cloud processing. Examines several basic and advanced GNN models. Provides instruction in common 3D point cloud processing tasks such as classification, segmentation, registration, and reconstruction. Covers implementing, optimizing, and evaluating GNN models for a variety of point cloud processing tasks.

**Prerequisite(s):** AAI 6710 with a minimum grade of C-

**AAI 6740. Applied Reinforcement Learning. (3 Hours)**

Introduces reinforcement learning, a subset of machine learning that focuses on training agents to make decisions with the aim of achieving specific objectives. Emphasizing practical experience, RL methods can be utilized to address real-world problems, including tasks related to design and optimization. At its core, RL revolves around agents interacting with their environments, learning from rewards and punishments, and continuously improving their decision-making skills. Emphasizes the adaptability of RL across various domains and how, with practical RL expertise and algorithms, RL can effectively address a wide array of industry challenges, ultimately enhancing its applicability and success in various professional settings.

**AAI 6790. Applied Quantum AI. (3 Hours)**

Introduces the integration of quantum computing and artificial intelligence. Explores the fundamentals of quantum algorithms and their applications to AI. Offers students an opportunity to obtain an understanding of the potential and challenges of quantum AI.

**AAI 6850. Applied Blockchain AI. (3 Hours)**

Explores extensively the integration of artificial intelligence and blockchain technologies. Offers students an opportunity to obtain a comprehensive understanding of blockchain fundamentals and the core principles of AI and to stay current with emerging trends in the ever-evolving field of blockchain AI. Underscores how these technologies complement each other, with blockchain enhancing security and trust while AI allows intelligent decision making. Examines crucial aspects such as security, privacy, and ethics using real-world case studies, ensuring a well-rounded AI approach.

**AAI 6900. AI for Autonomous Systems. (3 Hours)**

Explores the essentials of artificial intelligence and its practical applications in autonomous systems. Focuses on vital AI techniques such as machine learning, computer vision, and reinforcement learning. Offers students an opportunity to obtain expertise, to become independent decision makers, and to exercise innovation and control in such systems. Emphasizes hands-on learning involving real-world projects in perception, planning, control, and human-machine interactions while cultivating a deep understanding of AI technologies for autonomous systems. Projects in the course explore system efficiency and capabilities and study technology development across various industries.

**AAI 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**AAI 6980. Integrated Experiential Capstone. (4 Hours)**

Offers an immersive experience where students work in interdisciplinary teams, fostering collaboration, communication, and critical thinking while applying their artificial intelligence knowledge and skills to real-world problems. Examines thoroughly the methodologies associated with visualizing AI in practical situations. Investigates sophisticated visualization tools and techniques, while also researching the ethical considerations, interpretability, and real-world consequences of visually showcasing AI-based outcomes.

**Prerequisite(s):** AAI 6600 with a minimum grade of C- ; AAI 6610 with a minimum grade of C- ; AAI 6620 with a minimum grade of C- ; AAI 6630 with a minimum grade of C-

**AAI 6983. Special Research Topics in AI. (1-4 Hours)**

Covers special topics in artificial intelligence research. Topics vary by semester. May be repeated up to three times for a maximum of 15 semester hours.

**Applied Logistics - CPS (APL)****APL 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**APL 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**APL 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**APL 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**APL 6000. Foundations of Applied Logistics Execution. (3 Hours)**

Introduces students to the tactics of logistics and distribution. Explores application of fundamentals in the context of modern consumer expectations: endless shelf, immediate access, expanded notion of the last mile that includes delivery anywhere.

**APL 6010. Warehouse Management. (3 Hours)**

Introduces students to all aspects of warehouse management, from physical design to automation decisions to using data for capacity planning and optimization.

**APL 6020. Freight Management. (3 Hours)**

Introduces students to all aspects of freight management, carrier selection and management, rates, billing, decision analysis, rules, regulations, and transportation management systems. Emphasizes data use for optimization.

**APL 6030. ERP Systems for Inventory Management. (3 Hours)**

Covers the basics of enterprise resource planning (ERP) systems and inventory management, with hands-on tactics of product visibility for day-to-day operations. Focuses on inventory management technology and the organizational structure needed to support different channel networks in logistics.

**APL 6050. Supplier Management. (3 Hours)**

Covers tactics in managing suppliers for the day-to-day operations, including supplier appraisal, price and contract negotiations, supplier audits, supplier quality and delivery, and e-procurement.

**APL 6100. Advanced Technology in Logistics and Distribution. (3 Hours)**

Explores the latest technology development and how it applies to logistics and distribution science. Introduces concepts of emerging technologies and their use and purpose. Topics include the Internet-of-things (IoT) and its application in logistics, integrating IoT and cloud computing, machine learning applications, and the issues and challenges with new technology adoption.

**Prerequisite(s):** APL 6000 with a minimum grade of C- ; APL 6030 with a minimum grade of C-

**APL 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**APL 6980. Applied Logistics Capstone. (3 Hours)**

Offers students, working as individuals or in groups, an opportunity to design and carry out an interdisciplinary project conducted with real-world clients. Students apply strategic frameworks and best practices to help organizations improve logistics operations. Emphasizes the role of digital transformation, applied analytics, and the ability of digital technologies to help solve for disruptions in distribution and warehousing networks.

**APL 6983. Special Topics. (3 Hours)**

Offers students an opportunity to apply knowledge and skills gained through their master's program to work on challenging short#term special topics under faculty supervision. Students complete a project/research in which they examine a relevant problem of practice in logistics and supply chain, conduct research, analyze data, and present their findings. Topics may vary from semester to semester.

**Arabic (ARAB)****ARAB 1101. Elementary Arabic 1. (4 Hours)**

Designed for students with very little or no prior knowledge of Modern Standard Arabic. Provides a lively introduction to basic oral expression, listening comprehension, and elementary reading and writing. Uses practical vocabulary drawn from realistic situations, and aims at good pronunciation and ease in response. Laboratory practice complements class work, enables students to work aloud at their own speed, reinforces their acquisition of essential structures, and acquaints them with various audio-visual resources.

**ARAB 1102. Elementary Arabic 2. (4 Hours)**

Continues ARAB 1101. Reviews and continues the study of grammar and basic language skills. Offers progressively more intensive practice in oral and written communication. Laboratory practice complements class work, enables students to work aloud at their own speed, reinforces their acquisition of essential structures, and acquaints them with various audio-visual resources.

**Prerequisite(s):** ARAB 1101 with a minimum grade of C- or ARAB 1301 with a minimum grade of C-

**ARAB 1502. Introduction to Arab Culture. (4 Hours)**

Designed to provide students with an in-depth survey of Arab culture. Familiarizes students with the roots of one of the richest and oldest cultures but also seeks to satisfy their curiosity concerning certain social norms, patterns, and cultural traits in contemporary Arab societies. Examines cultural manifestations ranging from the hijab (head covering), Jihad (holy struggle), human rights, polygamy, gender relations, public behavior, and many others by providing the historical backgrounds for these customs and traditions as well as exploring how they are now perceived in various Arab societies as well as in the West. Seeks to provide students with an appreciation for this multifaceted culture but most importantly a broad perspective on Arab culture within the context of the universal human experience.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**ARAB 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARAB 2101. Intermediate Arabic 1. (4 Hours)**

Emphasizes further vocabulary building. Offers students an opportunity to master the fine points of grammar through written composition, prepared oral reports, and reading and discussion from current standard Arabic materials.

**Prerequisite(s):** ARAB 1102 with a minimum grade of C- or ARAB 1302 with a minimum grade of C-

**ARAB 2102. Intermediate Arabic 2. (4 Hours)**

Builds on ARAB 2101 and focuses on further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through written composition, prepared oral reports, and reading and discussion from current standard Arabic materials.

**Prerequisite(s):** (ARAB 2101 with a minimum grade of C- or ARAB 2301 with a minimum grade of C- )

**ARAB 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARAB 3101. Advanced Arabic 1. (4 Hours)**

Continues development of vocabulary. Offers students an opportunity to further develop grammar and conversation through advanced reading, composition, grammar review, and listening skills. Whenever possible, offers students an opportunity to engage in local community activities to enhance communication skills and cultural knowledge.

**Prerequisite(s):** ARAB 2102 with a minimum grade of C- or ARAB 2302 with a minimum grade of C-

**ARAB 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARAB 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARAB 4992. Directed Study. (1-4 Hours)**

Offers students a way of going beyond work given in the regular curriculum; may also enable students to complete major or minor requirements in certain situations. Priority is given to language majors and to juniors and seniors. May be repeated without limit.

**ARAB 5976. Directed Study. (1 Hour)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

## Architecture (ARCH)

### **ARCH 1000. Architecture at Northeastern. (1 Hour)**

Introduces students pursuing a major in the School of Architecture to the intellectual and extracurricular opportunities within the school and within the College of Arts, Media and Design. Exposes students to the cultural vibrancy of Boston with the goal of building networks to facilitate the creation of a vibrant and supportive learning community.

### **ARCH 1110. Fundamental Architectural Representation. (4 Hours)**

Introduces students to architectural representation as a form of documentation, experimentation, and communication through a series of exercises in orthographic, axonometric, and perspectival projection as well as physical and digital modeling. Supports the development of an iterative design methodology by introducing students to the tools of representation. Includes theoretical lectures and workshops in analog and digital media.

**Attribute(s):** NUpath Creative Express/Innov

### **ARCH 1120. Fundamental Architectural Design. (6 Hours)**

Introduces architectural design. Examines a number of approaches to spatial organization, massing, and envelope articulation through the analysis of pertinent case studies as well as through a series of fast-paced design exercises. Offers students an opportunity to develop a single design through a series of design studies that deal with issues of site planning, program, user input, and collective negotiation. Requires a portfolio demonstrating the student's representational abilities and iterative design process.

**Prerequisite(s):** ARCH 1110 (may be taken concurrently) with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov, NUpath Natural/Designed World

### **ARCH 1310. Buildings and Cities, A Global History. (4 Hours)**

Introduces students to architecture, as understood through buildings, cities, and landscapes from antiquity to the present. Studies important monuments in the global history of architecture, as well as tools for analyzing the built environment. Considers buildings in relation to their political, social, economic, and cultural context, and as expressions of diversity in human societies and cultural perspectives. Topics include the language of architecture, architectural drawings, the classical orders, the problem of ornament, construction techniques, materials, site, and the role of the patron. Develops students' eye for composition in two and three dimensions, aesthetic discrimination of detail, ability to see buildings as part of a larger social and cultural fabric, and critical judgment in speaking and writing.

**Corequisite(s):** ARCH 1311

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

### **ARCH 1311. Recitation for ARCH 1310. (0 Hours)**

Offers a small-group discussion format to cover material in ARCH 1310.

### **ARCH 1450. Understanding Design. (4 Hours)**

Introduces undergraduates at all levels to the importance of design thinking as a method of critical inquiry and creative expression. Class meetings include lectures and discussions on the power of design thinking to shape diverse facets of the natural and built environment—from cities and landscapes, to buildings and interiors, to the scale of the human body. In addition to class presentations, hands-on workshops introduce students to a range of tools and tactics for working creatively and iteratively through design and prototyping.

**Attribute(s):** NUpath Difference/Diversity, NUpath Creative Express/Innov

### **ARCH 1453. Designing the American City: Civic Aspirations and Urban Form. (4 Hours)**

Offers an interpretative look at the characteristic patterns of settlement and attitudes towards cities and urban life that are identified with American urbanization. Fosters a critical understanding of the cultural aspirations, processes, policies, planning, and design actions, which have influenced American urbanization, while introducing visual and analytic skills necessary for its interpretation.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

### **ARCH 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARCH 2130. Site, Space, Program. (6 Hours)**

Studies how to analyze, draw, and model the built environment. Students engage in issues of program, composition, type, and material. Offers students the opportunity to think conceptually about architectural design.

**Prerequisite(s):** ARCH 1120 with a minimum grade of D-

**ARCH 2140. Urban Housing. (6 Hours)**

Studies how to analyze, model, and intervene in the city. Offers students an opportunity to engage in urban analysis, urban massing strategies, and architectural design of urban housing.

**Prerequisite(s):** ARCH 2130 with a minimum grade of D-

**ARCH 2240. Architectonic Systems. (4 Hours)**

Introduces construction techniques and precise material realization of buildings as an integral part of architectural design thinking and processes. Uses historical and contemporary architectural precedents to explore the spatial and tectonic interrelationships of the primary constructional systems of wood, masonry, concrete, and steel. Uses a diverse mixture of student learning methods, including in-class lectures and student exercises; group discussions and guest lectures; textbook reading; and the production of construction models, drawings, and diagrams.

**Prerequisite(s):** ARCH 1110 with a minimum grade of D- or ARCH 2260 with a minimum grade of D- or ARCH 6100 (may be taken concurrently) with a minimum grade of C-

**Attribute(s):** NUpath Creative Express/Innov, NUpath Natural/Designed World

**ARCH 2260. Introduction to Building Systems. (4 Hours)**

Introduces fundamentals of building technology and explores technology as means and manifestation of architecture in the world. Using a systems approach, studies the interactions among natural forces, material properties, technological capabilities, and human cultural values and the ways these relationships give rise to architecture. Considers a series of physical principles—including gravity, moisture, heat, light, and air—to reveal specific architectural possibilities and material responses. Explores the ways design shapes the interaction of materials and forces to provide for human safety, shelter, comfort, and delight through a combination of hands-on workshops, seminal readings, and design exercises.

**Attribute(s):** NUpath Natural/Designed World

**ARCH 2310. History of Chinese Architecture. (4 Hours)**

Covers the development of the built environment in China from prehistory to the nineteenth century. Emphasizes technological transformation, structural and stylistic evolution, cultural exchange, and ideological engagement.

**Prerequisite(s):** ARCH 1310 with a minimum grade of D- or HIST 1250 with a minimum grade of D- or ASNS 1150 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture, NUpath Writing Intensive

**ARCH 2320. Modern Chinese Architecture. (4 Hours)**

Covers the development of the built environment in China from 1840 to the present. Emphasizes educational and professional shifts in architectural practice, political engagement in the design process, structural and technological transformation, conceptual background, and global impact.

**Prerequisite(s):** ARCH 1320 with a minimum grade of D- or HIST 1250 with a minimum grade of D- or ASNS 1150 with a minimum grade of D-

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions, NUpath Writing Intensive

**ARCH 2330. Architecture and the City in the Nineteenth Century. (4 Hours)**

Focuses on the history and theory of architecture and urban design in the nineteenth century. Emphasizes European architecture and urbanism and the ways in which European approaches to design shaped and were shaped by sustained cultural, political, and economic exchange with the Americas, Africa, and Asia. Major topics include the birth of the modern city and urban planning, capitalism and industrialization, new building typologies, infrastructure, urban parks and early suburbs, and new materials and technologies.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or graduate program admission

**Corequisite(s):** ARCH 2331

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions, NUpath Writing Intensive

**ARCH 2331. Recitation for ARCH 2330. (0 Hours)**

Offers a small-group discussion format to cover material in ARCH 2330.

**Corequisite(s):** ARCH 2330

**ARCH 2335. Architecture and Politics. (4 Hours)**

Draws on examples from the late 19th century to the present to study how governments have sought to use buildings and public spaces to advance political ideals. Considers a range of building projects (public buildings, housing, public spaces, infrastructure) advanced by liberal democracies as well as those designed for authoritarian regimes. Focuses on individual projects and the political circumstances tied to their making. Also considers the afterlife of projects associated with discredited regimes—especially those of Nazi Germany and Fascist Italy—as well as the ways in which private individuals, corporations, and other agencies have worked in tandem or in opposition to official narratives. Theoretical and critical texts that explore the dynamic between physical environment and political power help frame class discussion at key moments.

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**ARCH 2340. Modern Architecture. (4 Hours)**

Considers the forms and principles—as well as the sources for and development of—architecture and urbanism during the twentieth century. Explores the paradoxes within what has broadly been termed modernism, including the tension between historicism and innovation; between universal principles and regional expressions; between industry and craft; and between the utopian vision of planners and the role of individual will.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or graduate program admission

**Corequisite(s):** ARCH 2341

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions, NUpath Writing Intensive

**ARCH 2341. Recitation for ARCH 2340. (0 Hours)**

Offers a small-group discussion format to cover material in ARCH 2340.

**Corequisite(s):** ARCH 2340

**ARCH 2345. Contemporary Architecture. (4 Hours)**

Exposees students to a range of critical architectural practices and key theoretical frameworks from roughly 1990 through the present. Situates architectural production and discourse within a broader context of technological, cultural, and social processes, emphasizing the reciprocal exchange between architecture and its larger cultural and social context. Investigates the idea of the “contemporary” as both a temporal and conceptual notion, as well as the idea of a “critical” architecture and its relationship to both a historical avant-garde and “mainstream” architectural culture.

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**ARCH 2355. Architecture Conservation: Intervention, Transformation, and Reuse. (4 Hours)**

Examines how architecture and urban design respond to the challenges of intervening in already built environments, whether in the form of adaptation, extension, conservation, radical transformation, or sustainable reuse. Discusses cultural, social, as well as energy-efficiency-related topics. Includes a critical introduction to the key concepts of architectural intervention, followed by some exemplary design cases, and a special focus on recent and contemporary practices. Architecture deals with time, duration, change, and resilience. Places, not unlike palimpsests, retain multiple traces of former uses. Architects work with locations that inevitably contain a diversity of references and preexisting conditions. Students work on a “curatorial project,” that is, a conceptual proposal for an ephemeral intervention in an existing site.

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**ARCH 2370. Topics in Architectural History. (4 Hours)**

Covers a variety of topics in architectural history and theory. Taught by faculty according to their interests and expertise. May be repeated twice.

**Attribute(s):** NUpath Writing Intensive

**ARCH 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at consortium institutions. May be repeated without limit.

**ARCH 2991. Research in Architecture. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision.

**ARCH 3170. Architecture, Infrastructure, and the City. (6 Hours)**

Offers a studio course addressing the architectural and urbanistic consequences at the intersection of large-scale infrastructure and the contemporary city. Focuses on how to integrate buildings and neighborhoods with highways, rail lines, storm water management, bus, bike, parking, rivers, watersheds, and industrial networks.

**Prerequisite(s):** ARCH 2140 with a minimum grade of D-

**ARCH 3210. Environmental Systems. (4 Hours)**

Explores the interaction of environmental, physical, and energy systems in architecture. Offers students an opportunity to learn the fundamentals of building science as design opportunities to create particular conditions of light and shadow; provide shelter from heat, cold, and rain; and incorporate systems that provide for water, electricity, and sanitation. Course revolves around a series of workshops, labs, and design exercises.

**Prerequisite(s):** ARCH 2240 with a minimum grade of D- or CIVE 2260 with a minimum grade of D-

**Corequisite(s):** ARCH 3211

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**ARCH 3211. Recitation for ARCH 3210. (0 Hours)**

Offers a small-group discussion format to cover material in ARCH 3210 and provide opportunities for hands-on and creative work, both individually and in teams.

**Corequisite(s):** ARCH 3210

**ARCH 3351. Architecture Topics Abroad: Theory. (1-4 Hours)**

Explores, defines, and analyzes the embodied time within urban artifacts (ruins, buildings, urban landscape and space, infrastructure) of a historic context. Focuses on the architecture and urban artifacts that are the consequence of the evolutionary forces of urban civilization over long durations of time rather than focusing on iconographic examples of architecture and urbanism produced within a specific moment in history. Students engage in theoretical readings, group discussions, site visits, analyses of evolutionary urban artifacts, writing, and drawings. Assigned readings cover a broad range of theories about analyzing and interpreting the urban context and its history. These readings are complemented by both required writing assignments and site visits to many urban artifacts, buildings, and spaces. May be repeated up to three times for up to 16 semester hours.

**Attribute(s):** NUpath Interpreting Culture

**ARCH 3352. Architecture Topics Abroad: Drawing. (4 Hours)**

Examines and engages historic architecture and urbanism through freehand drawing. Offers students an opportunity to learn how to draw in freehand like an architect—drawing in a creative, interpretive, precise, and analytical manner—as well as to learn about the history and cultural context of the great architectural monuments and urban spaces that they are analyzing and drawing, including major architectural monuments. Studies new skills of drawing, the conventions of architectural representation, and the cultural history of the built environment. May be repeated without limit.

**Attribute(s):** NUpath Creative Express/Innov

**ARCH 3361. Topics in Global Architecture and Urbanism. (4 Hours)**

Covers the detailed history of architecture and urban development in a global city, from its founding to the present.

**Prerequisite(s):** ARCH 2340 with a minimum grade of D- or ARCH 2340 with a minimum grade of C- (Graduate)

**ARCH 3370. Advanced Topics in Architectural History. (4 Hours)**

Covers a variety of topics in architectural history and theory in depth. Requires students to develop a research project. Topics complement the mission of the department, the college, and the university. Taught by faculty according to their interests and expertise. Please consult department for current offerings.

**Attribute(s):** NUpath Writing Intensive

**ARCH 3430. Topics in Architectural Representation. (4 Hours)**

Covers a variety of topics in architectural representation. Focuses on essential architectural representation and communication skills across a range of technologies and media. Taught by faculty according to their interests and expertise. May be repeated twice.

**Prerequisite(s):** ARCH 1110 with a minimum grade of D-

**ARCH 3450. Advanced Architectural Communication. (4 Hours)**

Builds on CAD (computer-aided design) skills to develop ability to model in three dimensions and develop surfaces and lighting. Also addresses strategies in design communication for effective presentation of digital material.

**Prerequisite(s):** (ARCH 1110 with a minimum grade of D- ; ARCH 1120 with a minimum grade of D- ; ARCH 2130 with a minimum grade of D- ) or graduate program admission

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**ARCH 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at consortium institutions. May be repeated without limit.

**ARCH 4850. Urban and Architectural History Abroad. (4 Hours)**

Offers an on-site study of architecture and urban history conducted abroad. Instructors accompany students to visit and lecture about the most significant sites in the history of architecture, art, and urban development of a specific country. In comparison to a traditional on-campus course, the number of examples covered is smaller; however, each example is discussed in much greater detail. Encourages students to discover problems and aspects in art, architecture, and urbanism that have not been raised before, something only possible through direct survey and observation. Offers students an opportunity to obtain a real sense of architectural research without neglecting the basics of the field. Interactions with practicing architects, city planners, policymakers, preservationists, museum professionals, and artists are integral parts of this course.

**Attribute(s):** NUpath Interpreting Culture

**ARCH 4960. Architectural Studies Capstone. (4 Hours)**

Offers students an opportunity to deeply explore topics related to architecture and the built environment. Students complete a semester-long intensive research and writing capstone project. Offered in the final year of the BS in Architectural Studies program.

**Attribute(s):** NUpath Capstone Experience

**ARCH 4970. Junior/Senior Honors Project 1. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated without limit.

**ARCH 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at consortium institutions. May be repeated without limit.

**ARCH 4996. Experiential Education Directed Study. (4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major. Restricted to those students who are using the course to fulfill their experiential education requirement. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**ARCH 5115. Option Studio. (6 Hours)**

Offers an upper-level design studio that covers new studio topics, content, and studio instructors each semester. The studio instructors offer topical content that best aligns with their research and practice expertise, which provides students with the latest concepts in architectural design, theory, and research on a consistently updated and rotating basis. Students select their top choices of studio topics and instructors, giving them more flexibility in the areas for which they would like to focus their education. May be repeated twice for credit.

**Prerequisite(s):** ARCH 3170 with a minimum grade of D- or graduate program admission

**ARCH 5120. Comprehensive Design Studio. (6 Hours)**

Focuses on the materials and making of architecture. Considers architectural connections at all scales, from the nut and bolt to the scale of a door or window to the scale of the whole building and the city. Grounds design proposals upon a tectonic strategy, unlike traditional design studios that produce a schematic design before considering constructional ideas.

**Prerequisite(s):** ARCH 5110 with a minimum grade of C- or ARCH 5110 with a minimum grade of D- or ARCH 5115 with a minimum grade of C- or ARCH 5115 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience

**ARCH 5140. Capstone Studio. (6 Hours)**

Offers students an opportunity to propose design contributions to the built environment that are responsive to social, cultural, and environmental contexts at multiple scales, drawing on a student's full architectural education experience. The topic of the studio is determined by the studio professor each semester and is organized around consistent and essential studio parameters and outcomes.

**Attribute(s):** NUpath Capstone Experience

**ARCH 5210. Environmental Systems. (4 Hours)**

Explores the ways in which architectural form can create particular conditions of light and shadow; provide shelter from heat, cold, and rain; and incorporate systems that provide for water, electricity, and sanitation. Provides a series of simple and straightforward small-scale design projects.

**Corequisite(s):** ARCH 5211

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**ARCH 5211. Recitation for ARCH 5210. (0 Hours)**

Offers a small-group discussion format to cover material in ARCH 5210.

**Corequisite(s):** ARCH 5210

**ARCH 5220. Integrated Building Systems. (4 Hours)**

Studies how to integrate into students' building designs all the environmental and tectonic systems that they have covered in previous architecture courses.

**Prerequisite(s):** ARCH 3210 with a minimum grade of D- or ARCH 5210 with a minimum grade of D- or ARCH 5210 with a minimum grade of C- (Graduate)

**ARCH 5230. Structural Systems. (4 Hours)**

Introduces the fundamental concepts of structural analysis and design for architecture. Examines the nature of forces and their effects on different types of structural elements; the structural properties of shapes and materials; and the selection, analysis, and design of efficient structural systems that resist the loads acting upon them. Uses historical and contemporary examples to illustrate how the changing context of architectural ideas drives structural form and the selection of structural systems. Includes field trips and student presentations of structural models and diagrams. Restricted to students in the architecture BS program and to students in the three-year MArch program.

**Prerequisite(s):** ((PHYS 1151 with a minimum grade of D- or PHYS 1141 with a minimum grade of D- ); (MATH 1341 with a minimum grade of D- or MATH 1241 with a minimum grade of D- ); ARCH 2240 with a minimum grade of D- ) or graduate program admission

**Corequisite(s):** ARCH 5231

**Attribute(s):** NUpath Formal/Quant Reasoning, NUpath Natural/Designed World

**ARCH 5231. Recitation for ARCH 5230. (0 Hours)**

Provides a small-group discussion format to cover examples from the material in ARCH 5230.

**Corequisite(s):** ARCH 5230

**ARCH 5310. Design Tactics and Operations. (4 Hours)**

Encourages students to develop the connections between critical attitudes and techniques in design, through important historical texts. Offers a kind of "great books" approach to the integration of design and history, introducing the writings and seminal designs of Alberti, Palladio, Wright, Le Corbusier, Semper, Sitte, Rowe, Colquhoun, Moneo, Koolhaas, Rossi, Frampton, Venturi and Scott Brown, Scarpa, and Lynch.

**ARCH 5312. Mapping and Building Health. (4 Hours)**

Introduces students to historical and contemporary frameworks linking the built and natural environment to health outcomes. Examines analog (field documentation) and digital (GIS) spatial mapping techniques for identifying risks and opportunities for health. Offers students an opportunity to engage in interdisciplinary creative problem solving for real-world scenarios and to write essays on selected topics.

**Attribute(s):** NUpath Capstone Experience

**ARCH 5314. Planning and the Built Environment. (4 Hours)**

Examines how speculative real estate development, public investments in infrastructure, and policy priorities intersect to shape the physical form and social structure of the built environment. Considers contemporary issues and dilemmas through the lens of historical examples of the capitalist city from the 1840s until the 2010s.

**ARCH 5330. Theories of Architecture and Urbanism. (4 Hours)**

Exposes students to a range of critical practices and key theoretical frameworks within modern and contemporary architecture and urbanism. Studies architectural production and discourse within a broader context of technological, cultural, and social processes. Emphasizes the reciprocal exchange between architecture and its larger cultural and social context.

**ARCH 5340. Architectural and Urban Histories. (4 Hours)**

Explores key buildings, figures, and concepts in architectural history. Designed to familiarize students with a range of materials related to the built environment, with a particular emphasis on approaches and frameworks for analyzing such material. Focusing on the local built environment, students visit buildings and landscapes in person to develop visual analytical skills. Materials and in-class discussions provide additional context and frameworks for the study of the buildings and spaces that are the primary focus of the course.

**ARCH 5370. Topics in Architectural Design Theory. (4 Hours)**

Covers a variety of topics in architectural design theory. Examines a range of theories on the interrelationships between the social, political, and physical dimensions of architecture and urbanism. Topics vary by class section. May be repeated twice.

**ARCH 5430. Introduction to Professional Practice in Architecture. (4 Hours)**

Focuses on how architectural practice occurs and must be understood within a larger social context, and seeks to make sense of this broader social contract from the perspective of professional design practice. Investigates normative and critical professional practices through selected readings and individual field research. Discusses the dynamic, diverse, and complex interests and objectives from the constellation of participants that bring a building to completion, especially in an urban environment. Develops project case studies that provide examples of excellent design results achieved through the application of expert professional practices.

**ARCH 5530. Innovative Models in Real Estate Development and Design. (4 Hours)**

Addresses advanced topics in real estate development and finance and examines innovative models of practice in real estate development available to design professionals. Studies a set of advanced analytical tools and techniques for evaluating the cash flows and economic returns of real estate investment and development. Introduces advanced methods of financing real estate and the structure of capital markets involved in property assets. Uses the case instruction method and includes active, discussion-oriented learning.

**Attribute(s):** NUpath Capstone Experience

**ARCH 5850. Architecture Topics Abroad: History. (4 Hours)**

Studies the city as a site of creativity and innovation, with a special focus on particular cases of study. Introduces the contemporary city from a historical, social, and economic perspective, followed by presentations on examples of creativity and innovation in the fields of architecture and urban design.

**ARCH 6100. Graduate Skills Studio. (6 Hours)**

Presents students new to architecture with the fundamentals of three-dimensional thinking and spatial representation with a series of increasingly complex assignments. Offers students an opportunity to learn a wide variety of graphical software tools and then use these tools to complete their assignments. Covers freehand sketching and physical model building skills. This intensive course is taught as a hands-on design studio (with ample studio access outside class meetings).

**ARCH 6115. Urban Architecture Studio. (6 Hours)**

Engages students with a series of design interventions to improve our public realm. Touches on decarbonization and adaptive reuse topics at the scale of the human, material, building, and urban networks. Explores these ideas by offering students projects in small, underutilized city-owned land to test collaborative programming and microinfrastructure shaped by communities' needs and desires.

**ARCH 6200. Graduate Studio 1: Architectural Design. (6 Hours)**

Focuses on a series of increasingly complex assignments that emphasize the fundamentals of architectural design. Offers students an opportunity to propose and test proposals through an iterative process using a wide variety of tools and media, including design software, physical models, and freehand sketches. Explores spatial definition, the orchestration of a spatial sequence, modulation of natural light, and responsiveness to existing conditions (whether natural or man-made). Taught as a hands-on design studio (with ample studio access outside class meetings).

**ARCH 6330. Seminar in Modern Architecture. (4 Hours)**

Examines the state of architecture and urbanism in the two decades leading up to 2000. Explores contemporary issues in architectural theory and urban design. Examines a broad range of ideas affecting contemporary developments in architectural practice. Engages cultural and historical forces as well as contemporary criticism to define the nature of modernism, late modernism, postmodernism, and deconstruction. Case studies, analysis of theoretical models, and application of methods of history provide students with support for their own design work in studio and co-op experiences.

**ARCH 6340. Graduate Topics in Architecture. (4 Hours)**

Explores focused research topics relevant to the graduate program curriculum. The professor presents his or her research related to a particular urban, architectural, or technical topic. This exposes the students to methods of research and topics in current and ongoing research in the field. The students have an opportunity to engage in related and parallel research projects during the course of the semester. May be repeated without limit.

**ARCH 6430. Case Studies 1. (4 Hours)**

Focuses on how architectural practice occurs and must be understood within a larger social context. The cultures-interests and objectives-of the constellation of participants in the bringing of a building to completion are dynamic, diverse, and complex, especially in an urban environment. Seeks to make sense of this broader social contract from within the perspective of professional design practice. As one of many participants in the process of bringing a building to completion, students review the roles, responsibilities, and interests of each contributor. Our task is to understand the obligations and constraints that constitute these relationships. Examines the products of design as manifestations of these relationships and situates them within a discourse of value-determined actions. Investigates normative and critical professional practices through selected readings and individual field research. Develops project case studies that provide examples of excellent design results achieved through the application of expert professional practices.

**ARCH 6440. Case Studies 2. (4 Hours)**

Continues ARCH 6430. Builds on the understanding of professional practice developed in the previous course and investigates the array of "artful ways in which some practitioners deal competently with the indeterminacies and value conflicts of practice." These indeterminacies, uncertainties, and value conflicts are part of a rapidly changing, dynamic world. There is an unprecedented need for flexible and responsive practices that can bridge the gap between traditional professional techniques and these situations. Requires core competencies that are not mismatched with the changing situations of practice. Requires new skills as well as traditional analytic techniques to respond adequately to these unique conditions of work. Through a closer examination and development of an in-depth project case study, students speculate on possible approaches to a revised and restructured model of professional knowledge and guidelines for reflective practice that can sustain a culture of design excellence.

**Prerequisite(s):** ARCH 6430 with a minimum grade of C-

**ARCH 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARCH 7120. Integration Studio. (6 Hours)**

Focuses on building systems, their detailing, assembly, and integration to achieve architectural expression and measurable performance over time. Offers students an opportunity to draw on the full range of their prior architectural education to produce a design that synthesizes specific criteria to build sustainable and culturally valuable environments for generations of human use.

**Corequisite(s):** ARCH 7220

**ARCH 7130. Master's Research Studio. (6 Hours)**

Offers the research portion of a two-part graduate project focused on the complex issues facing the postindustrial landscape of the contemporary city. Examines in detail the design elements of everyday building types, such as office buildings, labs, parking garages, and retail spaces, with an eye toward creating new prototypes for urban architecture that are informed by the realities of contemporary market forces. Provides the foundation for the more speculative design proposals of ARCH 7140. May be repeated without limit.

**ARCH 7140. Master's Degree Project. (6 Hours)**

Offers the second of a two-part degree project focused on manipulating contemporary market-driven building types. Seeks to invent new variations and hybrids from the existing store of urban building types to address new challenges, such as irregular sites, new adjacencies, and other unmet demands in cities. Based on research, analysis, and modeling of different types done in the first semester, offers students an opportunity to propose synthetic solutions to the complex problems of postindustrial development, housing, and identity facing the contemporary city. May be repeated without limit.

**ARCH 7220. Integrated Building Systems. (4 Hours)**

Explores the theories and practices of integrating building systems to create high-performing, long-lasting, and humane architecture. Uses readings and case studies to critically examine how the architectural order and logics derived from ecosystems, materials, and human uses express the systemic nature of buildings. Offers students an opportunity to synthesize their prior knowledge of construction systems, environmental systems, and structural systems to consider buildings as an integrated system of systems. Engages students with multiple forms of modeling, representation, and specification through which the speculative process of design anticipates the physical processes of construction, occupancy, and change.

**ARCH 7430. Topics In Research Methods in Architectural Design. (4 Hours)**

Focuses on contemporary research strategies and ethics in architecture, landscape, and urbanism. Presents an overview of social science, public engagement, and spatial analytics methods for design with an eye toward developing integrated analysis, visualization, and conceptualization skills for collaborative and individual project development. Themes include ecological, economic, and social resiliency in urban environments. Offers students an opportunity to formulate original approaches to design thinking and research. May be repeated five times for a maximum of 24 semester hours.

**ARCH 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at consortium institutions. May be repeated without limit.

**ARCH 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

**Army ROTC (ARMY)****ARMY 1101. Introduction to the Army and Critical Thinking. (1 Hour)**

Introduces cadets to the Army and the Profession of Arms. Examines the Army profession and what it means to be a professional in the U.S. Army. Offers students an opportunity to develop basic knowledge and comprehension of the Army Leadership Requirements Model while gaining a complete understanding of the Reserve Officers' Training Corps (ROTC) program, its purpose in the Army, and its advantages for the student. Cadets also have an opportunity to learn how resiliency and fitness support their development as an Army leader. Includes a leadership laboratory where cadets conduct practical applications of their military science curriculum.

**ARMY 1102. Introduction to the Profession of Arms. (1 Hour)**

Introduces cadets to the personal challenges and competencies that are critical for effective leadership. Offers cadets an opportunity to learn how the personal development of life skills such as critical thinking, time management, goal setting, and stress management relate to leadership and the Army profession; to learn the basics of the communications process; and the importance for leaders to develop the essential skills to effectively communicate in the Army. Includes a leadership laboratory where cadets conduct practical applications of their military science curriculum.

**ARMY 2201. Leadership and Decision Making. (3 Hours)**

Focuses on leadership and decision making. Seeks to add depth to the cadets' understanding of the Adaptability Army Learning Area. Outcomes are demonstrated through critical and creative thinking and the ability to apply troop leading procedures (TLP) to apply innovative solutions to problems. The Army profession is also stressed through leadership forums and a leadership self-assessment. Requires students to apply their knowledge outside the classroom in a hands-on performance-oriented environment during leadership labs and other field activities (team-building exercises, leadership development exercises).

**ARMY 2202. Army Doctrine and Team Development. (3 Hours)**

Focuses on Army doctrine and team development. Begins the journey to understand and demonstrate competencies as they relate to Army doctrine, Army values, teamwork, and warrior ethos. Stresses their relationship to the law of land warfare and philosophy of military service. Covers the ability to lead and follow through team-building exercises in small units up to squad level. Requires students to apply their knowledge outside the classroom in a hands-on performance-oriented environment during leadership labs and other field activities (team-building exercises, leadership development exercises).

**ARMY 2212. Army Doctrine and Team Development Lab. (0 Hours)**

Accompanies ARMY 2202. Introduces basic soldier skills and squad-level tactical operations in leadership lab. Includes participation in physical fitness training.

**ARMY 3301. Training Management and the Warfighting Functions. (4 Hours)**

Focuses on training management and the warfighting functions. Constitutes an academically challenging course where the cadet is required to study, practice, and apply the fundamentals of training management and how the Army operates through the warfighting functions. At the conclusion of this course, the successful cadet should be capable of planning, preparing, and executing training for a squad conducting small-unit tactics. Requires students to apply their knowledge and leadership competencies outside the classroom in a hands-on performance-oriented environment during leadership labs and other field activities (team-building exercises, leadership development exercises). Requires prior completion of ARMY 1101, ARMY 1102, ARMY 2201, and ARMY 2202 or equivalent military experience.

**ARMY 3302. Applied Leadership in Small Unit Operations. (4 Hours)**

Focuses on applied leadership in small-unit operations. Constitutes an academically challenging course where the cadet is required to study, practice, and apply the fundamentals of direct-level leadership and small-unit tactics at the platoon level. At the conclusion of this course, the successful cadet should be capable of planning, coordinating, navigating, motivating, and leading a platoon in the execution of a mission. Seeks to prepare the cadet for the ROTC Cadet Leader Course (CLC), which the cadet attends in the summer at Fort Knox, KY. Requires students to apply their knowledge and leadership competencies outside the classroom in a hands-on performance-oriented environment during leadership labs and other field activities (team-building exercises, leadership development exercises). Requires prior completion of ARMY 1101, ARMY 1102, ARMY 2201, and ARMY 2202 or equivalent military experience.

**ARMY 3513. American Military History Lab. (0 Hours)**

Offers a leadership lab introducing basic soldier skills and squad-level tactical operations.

**ARMY 4011. The Army Officer. (4 Hours)**

Focuses on development of the Army officer. Constitutes an academically challenging course where the cadet has an opportunity to develop knowledge, skills, and abilities to plan resources and assess training at the small-unit level and to learn about Army programs that support counseling subordinates and evaluating performance, values, and ethics; career planning; and legal responsibilities. At the conclusion of this course, the successful cadet should be familiar with how to plan, prepare, execute, and continuously assess the conduct of training at the company or field-grade officer level. Requires students to apply and refine their leadership competencies as they develop and plan outside the classroom in hands-on performance-oriented environments during leadership labs and other field activities (team-building exercises, leadership development exercises).

**ARMY 4012. Mission Command and the Company Grade Officer. (4 Hours)**

Offers cadets an opportunity to develop knowledge, skills, and abilities required of junior officers pertaining to the Army in unified land operations and company-grade officer roles and responsibilities. Includes small-group assignments, briefings, case studies, practical exercises, and an oral practicum. The oral practicum explores the cadet's knowledge of preparation for the 20 Army warfighting challenges covered throughout the advanced course. Seeks to assist the cadet in preparing for the BOLCB course and is a mandatory requirement for commissioning. Requires students to apply and refine their leadership competencies as they develop and plan outside the classroom in hands-on performance-oriented environments during leadership labs and other field activities (team-building exercises, leadership development exercises).

**ARMY 4411. The Army Officer Lab. (0 Hours)**

Introduces basic soldier skills and squad-level tactical operations in leadership lab. Includes participation in physical fitness training.

**Art - CPS (ART)****ART 1145. American Cinema. (3 Hours)**

Explores the uniquely distinguishing characteristics of American cinema. Covers camera angles, lighting, editing, sound, acting, narrative structure, and construction of point of view. Analyzes such recurring concerns of American cinema as the individual and community, issues of masculinity and violence, urban alienation, uprootedness, and adolescence.

**Attribute(s):** NUpath Interpreting Culture

**ART 1200. Digital Photography. (3 Hours)**

Designed to acquaint the beginner with the use of digital tools to manipulate and create digital imagery. Offers students an opportunity to learn to create a 360-degree panoramic photograph, digital slideshows, photographs for the web, and advanced techniques for negative scanning and advanced RAW file manipulation. Requires weekly assignments, demonstrations, hands-on experience, and a final portfolio. Students must supply their own 4-megapixel or greater camera. Intended as an entry-level course for visual artists and amateur photographers who wish to learn to express themselves using digital imaging.

**Attribute(s):** NUpath Creative Express/Innov

**ART 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ART 2000. Typography: Communicating Content with Form. (3 Hours)**

Offers students an opportunity to obtain an understanding of effects produced by fonts and typographic techniques used in contemporary visual design. Uses computer-based graphic design software to present a historical overview of typography and to explore formal qualities of characters and typefaces through applied projects. Seeks to guide students' understanding of how successful graphic design that includes letters and words depends on clear and appropriate typography to express and communicate information.

**Attribute(s):** NUpath Creative Express/Innov

**ART 2100. Foundation in Visual Communication. (3 Hours)**

Offers students an opportunity to gain knowledge of the fundamental elements of 2D design in order to explore the concept of pictorial order and to understand the principles of organization and formal elements of 2D design as communication tools.

**Attribute(s):** NUpath Creative Express/Innov

**ART 2200. Fundamentals of Graphics and Publishing Production. (3 Hours)**

Introduces the terminology, concepts, and applications of computer graphic software, including vector-based, raster-based, page layout, and PDF (Portable Document Format) creation programs. Offers students an opportunity to design, develop, and produce a variety of communication projects using a combination of industry-standard production tools.

**Prerequisite(s):** ART 2000 with a minimum grade of D-

**ART 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ART 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ART 4950. Seminar. (1-4 Hours)**

Offers an in-depth study of selected topics.

**ART 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**ART 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ART 4995. Practicum. (1-4 Hours)**

Provides eligible students with an opportunity for practical experience.

**ART 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Art - Design (ARTG)****ARTG 1001. Design Perspectives: An Introduction to Design in the World. (2 Hours)**

Introduces students to a range of perspectives and points of view on design as a human activity. Explores a mix of theories, principles, practices, and histories that constitute various understandings of design across cultures. Through illustrative case studies, examines impacts, influences, accomplishments, consequences, possibilities, and limits of design in the world. Investigates what it means to develop a personal design practice.

**Corequisite(s):** ARTG 1002

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**ARTG 1002. Seminar for Design Perspectives. (2 Hours)**

Offers a small-group discussion format to cover material in ARTG 1001 and provides opportunities for the application of course topics.

**Corequisite(s):** ARTG 1001

**ARTG 1250. Design Process Context and Systems. (4 Hours)**

Explores common design practices, principles, and vocabularies, introducing the design process as a method of inquiry and problem solving through studio projects. Emphasizes the importance of an awareness of audience and context in the creation of meaningful communications and experiences. Explores the practice of design as an iterative process, offering students an opportunity to obtain an understanding of the value of systems thinking and the importance of feedback and exchange as a means for assessing the quality of design's effectiveness in helping users achieve their goals.

**Attribute(s):** NUpath Creative Express/Innov

**ARTG 1270. Design: Process + Practices. (2 Hours)**

Introduces students to a range of design practices demonstrated through case studies, activities in lecture and workshop, and presentations by design practitioners.

**Corequisite(s):** ARTG 1271

**ARTG 1271. Studio for Design: Process + Practices. (2 Hours)**

Explores common design practices, principles, and vocabularies, introducing the design process as a method of inquiry and problem solving through studio projects in the areas of graphic, information, interaction, and experience design. Emphasizes the importance of an awareness of audience and context in the creation of meaningful communications and experiences. Explores the practice of design as an iterative process, fostering an understanding of the value of systems thinking and the importance of feedback and exchange as a means for assessing the quality of design's effectiveness in helping participants achieve their goals.

**Corequisite(s):** ARTG 1270

**ARTG 1290. Typographic Systems. (2 Hours)**

Covers typography as a core element of graphic design. Examines typography's history, development, and contemporary state. Studies typography principles and how to apply them in different contexts and formats. Introduces the cultural meaning of and diversity of typography and the importance of research while engaging with it. Through appreciation, curiosity, engagement, and discipline, initiates an intellectual investigation and practice of what it means to work with typography and apply typography in different disciplines.

**Prerequisite(s):** ARTF 1122 with a minimum grade of D- or ARTF 1220 with a minimum grade of D-

**Corequisite(s):** ARTG 1291

**ARTG 1291. Studio for Typographic Systems. (2 Hours)**

Introduces letterforms in visual communication. Studies typography as a form in terms of its function and explores visual principles affecting the organization and access of typographic information. Explores how to organize words and phrases to create clear meanings. Introduces the use of the typographic grid and issues of hierarchy and legibility through assigned projects, readings, and lectures. Includes the historical evolution of typefaces and their classification as a rational system. Guides students in the application of typography as the basis of organizing and expressive principle of graphic design.

**Corequisite(s):** ARTG 1290

**ARTG 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTG 2242. Information Design Principles. (4 Hours)**

Introduces foundational concepts, methods, and procedures for the creation of data-rich information graphics. Investigates and implements visual systems and information structures such as maps, graphs, infographics, charts, and diagrams. Explores conceptual and visual solutions, and the creative process of organizing, visualizing, and communicating information. Examines design solutions that make complex information easier to understand and use. Course experiences include: analysis of design case studies and other critical readings, lectures, class discussions, and individual in-studio design work.

**Prerequisite(s):** ARTF 1122 with a minimum grade of D- or ARTF 1220 with a minimum grade of D-

**ARTG 2250. Typography 1. (4 Hours)**

Introduces typography as the basis of graphic design and visual communication. Guides students through an understanding of letterforms, words, sentences, and text as both image and information. Studies form, context, and visual meaning. Introduces use of the typographic grid and issues of hierarchy and legibility through assigned projects, readings, and lectures. Includes the historical evolution of typefaces and their classification as a rational system.

**Prerequisite(s):** ARTF 1122 with a minimum grade of D- or ARTF 1220 with a minimum grade of D-

**Corequisite(s):** ARTG 2251

**Attribute(s):** NUpath Creative/Innov

**ARTG 2251. Type Tools. (1 Hour)**

Offers students an opportunity to acquire technical software skills used in typesetting, such as Adobe InDesign, in this introductory lab.

**Corequisite(s):** ARTG 2250

**ARTG 2252. Graphic Design Principles. (4 Hours)**

Introduces foundational graphic design principles, processes, and methods for creating meaning within function, content, and context. Covers graphic form and vocabulary. Uses typography; language; image; symbolism; and visual principles of composition, hierarchy, rhythm, balance, scale, texture, pattern, grid, value, and color to create effective visual communication. Analyzes design case studies and offers critical readings, lectures, class discussions, and individual in-studio design work.

**Prerequisite(s):** ARTF 1122 with a minimum grade of D- or ARTF 1220 with a minimum grade of D-

**ARTG 2260. Programming Basics. (4 Hours)**

Exposes students to basic programming design for user interfaces. Offers students an opportunity to become familiar with the logical elements of programming languages. Through lectures, hands-on in-class exercises, and modular projects, explores Web-based design and programming solutions for managing interaction and animation.

**ARTG 2262. Prototyping with Code. (2 Hours)**

Introduces students to creative coding and algorithmic thinking through creative projects. Students prototype projects by starting with preproduction exercises like flowcharts and pseudocode before proceeding to writing modular code, then testing and debugging, and finally writing reflection documentation. Introduces multiple programming platforms that can be used for the completion of coursework, allowing students flexibility in coding their project visions. Lecture sessions combine topical lectures with live coding and code walks of example code.

**Corequisite(s):** ARTG 2263

**Attribute(s):** NUpath Formal/Quant Reasoning

**ARTG 2263. Lab for ARTG 2262. (2 Hours)**

Introduces students to creative coding and algorithmic thinking through creative projects. Lab sessions consist of team-based code walks, activities, and problem solving. Students can use different software platforms to complete creative coding projects.

**Corequisite(s):** ARTG 2262

**ARTG 2290. Fashion and Wearable Technologies. (4 Hours)**

Introduces key social, environmental, and technical challenges underpinning sustainable innovation in the fashion, wearable technology, and smart textiles industries. Examines inclusive design and circular economy principles and uses them as a framework within which to analyze complex socio-technical networks of production, use and disposal of fashion, wearable technology, and smart textile products, and their impacts on health and wellbeing, society and the planet. Presents the opportunity to gain firsthand experience of the complex nature of today's open, dynamic, and networked problems through a site visit, case studies, and a series of practical activities. Instills understanding of creative intelligence and innovation as a field of practice.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**ARTG 2400. Interaction Design Principles. (4 Hours)**

Introduces foundational interaction design principles, processes, and tools for creating physical and screen-based interfaces. Uses design research methods, stakeholder identification, problem framing, information structuring, low- to high-fidelity prototyping techniques, iterative development, assessment strategies, and usability testing to construct design proposals for interactive artifacts. Analyzes design case studies and offers critical readings, instructor and guest lectures, class discussions, and individual and collaborative in-studio design work.

**Prerequisite(s):** ARTF 2223 with a minimum grade of D- or ARTF 1250 with a minimum grade of D-

**ARTG 2401. Interaction Design Principles Tools. (1 Hour)**

Introduces skills and software used in designing and developing Web-based interactive environments. Explores Web-page scripting and tagging, CSS-based design coding, options for front- and back-end page design connections, and alternative technologies.

**Prerequisite(s):** ARTG 2400 (may be taken concurrently) with a minimum grade of D-

**ARTG 2810. Creative Fabrication Design Principles. (4 Hours)**

Introduces theoretical, methodological, and practical approaches to transforming physical products into meaningful, contextual experiences. Analyzes real-world examples through observation, reverse engineering, and critical discussion, identifying technical and cultural factors that shape impactful interactions between environments, products, and people. Fieldwork at a major global design event forms a central component, fostering direct engagement with contemporary design practices. Emphasizes accessibility, meaning making, sustainability, and social impact, exploring their resonance across users, communities, and stakeholders. Integrates theory and practice through field research and applied design projects, culminating in comprehensive analysis, innovative reporting tools, the application of meta-design principles to design guidelines for future product-related experiences, and the creation of frameworks for others to design.

**Prerequisite(s):** ARTG 1270 with a minimum grade of D- ; ARTG 1271 with a minimum grade of D-

**ARTG 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTG 3100. Physical and Digital Fabrication. (4 Hours)**

Explores interdisciplinary projects and themes in immersive media and physical making by fabricating novel artifacts and experiences. Students form groups to create design solutions to wicked problems. Student teams follow a hackathon model to explore multiple ideas quickly. By engaging in critique and studio practice, offers students an opportunity to demonstrate and grow their technical skills.

**Prerequisite(s):** ARCH 2260 with a minimum grade of D- or ARTD 2000 with a minimum grade of D- or ARTF 1124 with a minimum grade of D- or (ARTF 1230 with a minimum grade of D- ; ARTF 1231 with a minimum grade of D- ) or ARTG 2260 with a minimum grade of D- or (ARTG 2262 with a minimum grade of D- ; ARTG 2263 with a minimum grade of D- ) or CS 2510 with a minimum grade of D- or GE 1502 with a minimum grade of D-

**ARTG 3250. Physical Computing. (4 Hours)**

Explores the communication between the physical world and the interactive, computer-based interface. Examines the potential of reactive analog and digital devices embedded within the physical realm. Offers students an opportunity to use simple kit sensors and indicators designed to enable student teams to create interfaces triggered by gesture, bodily movement, physical forces, and other tangible actions. Concludes with discussions of more complex interactive devices, the relationship between physical computing and robotics, and possible future directions.

**Prerequisite(s):** ARTG 2400 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Creative Express/Innov

**ARTG 3350. Typography 2. (4 Hours)**

Continues ARTG 2250, exploring structures and hierarchies through increasing typographic complexity. Investigates meaning, legibility, and readability with an emphasis on voice, organization, sequence, and the typographic grid.

**Prerequisite(s):** (ARTG 1290 with a minimum grade of D- ; ARTG 1291 with a minimum grade of D- ) or (ARTG 1290 with a minimum grade of S ; ARTG 1291 with a minimum grade of S ) or ARTG 2250 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**ARTG 3352. Interaction Design Basics. (4 Hours)**

Introduces basic principles of interactive design, such as orientation, navigation, hierarchy, categorization, user expectation, usability, and responsiveness. Explores these concepts through the creation of Web-based user interfaces.

**Prerequisite(s):** (ARTF 1250 with a minimum grade of D- or ARTF 2223 with a minimum grade of D- ); ARTG 2250 with a minimum grade of D-

**ARTG 3400. Topics In Interaction Design Inquiry. (4 Hours)**

Focuses on a specific intermediate-level topic of timely relevance to the domain of interaction design. May be repeated up to two times for a maximum of 12 semester hours. Topics vary each semester.

**Prerequisite(s):** ARTG 2400 with a minimum grade of D-

**ARTG 3444. Topics in Information Design Inquiry. (4 Hours)**

Focuses on a specific intermediate-level topic of timely relevance to the domain of information design. May be repeated up to two times for a maximum of 12 SH.

**Prerequisite(s):** ARTG 2242 with a minimum grade of D-

**ARTG 3450. Graphic Design 2. (4 Hours)**

Explores the conceptual potential inherent in the merging of words/text with images/symbols to achieve a level of communication that exceeds the sum of visual and verbal components. Examining how the relationship of verbal and visual content can enhance meaning and comprehension, students identify a social issue of personal relevance and create a visual campaign targeting a core audience. Through a process including projects, readings, and lectures/discussions, students research, frame concepts, explore visual decisions, and determine appropriate deliverables.

**Prerequisite(s):** ARTG 2252 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**ARTG 3451. Information Design 1. (4 Hours)**

Introduces basic concepts, methods, and procedures of information design with a focus on mapping information. Students investigate visual systems and information structures such as maps, graphs, charts, and diagrams. Emphasizes the creative process of organizing, visualizing, and communicating data by making complex information easier to understand and use.

**Prerequisite(s):** ARTG 3350 with a minimum grade of D-

**ARTG 3452. Topics In Graphic Design Inquiry. (4 Hours)**

Focuses on a specific intermediate-level topic of timely relevance to the domain of graphic design. May be repeated up to two times for a maximum of 12 semester hours.

**Prerequisite(s):** ARTG 2252 with a minimum grade of D-

**ARTG 3460. Identity and Brand Design. (4 Hours)**

Addresses the origins, significance, and consequence of identity and branding expressions, in diverse media, in terms of personal, cultural, and commercial values. Using design research and studio methods, a series of exercises explores expressions of individual and collective identity. Offers students an opportunity to work in teams to develop branding projects in a process designed to increase their capacity to create effective brand expressions and analyze semiotic significance and cultural and economic value. Critique of work and presentation of concepts of identity and brand seek to sharpen students' skills and challenge their ideas about brand. External critique seeks to create valuable tests of bias and assumptions, while principles of managing attention and trust seek to build the ability to function as a brand steward in actual practice.

**Prerequisite(s):** (ARTG 1290 with a minimum grade of D- ; ARTG 1291 with a minimum grade of D- ) or (ARTG 1290 with a minimum grade of S ; ARTG 1291 with a minimum grade of S ) or ARTG 2250 with a minimum grade of D-

**ARTG 3462. Experience Design Principles. (4 Hours)**

Introduces foundational experience design principles, processes, and methods for understanding and creating conditions and interventions that impact people's experiences. Uses design research methods, stakeholder identification, visual synthesis of research findings, and problem framing as means to understand the motivations, behaviors, and values of audiences and participants. Develops scenarios and prototypes to construct design proposals informing people's relationships and experiences with products, environments, and services. Analyzes design case studies and offers critical readings, lectures, class discussions, and individual in-studio design work.

**Prerequisite(s):** ARTF 1250 with a minimum grade of D- or ARTF 2223 with a minimum grade of D- or ARTG 1250 with a minimum grade of D- or (ARTG 1270 with a minimum grade of D- ; ARTG 1271 with a minimum grade of D- )

**ARTG 3463. Experience Design 2. (4 Hours)**

Continues ARTG 3462 processes and strategies for creating compelling human-centered experiences. Offers students an opportunity to use design processes from multiple disciplines to develop real-world solutions.

**Prerequisite(s):** ARTG 3462 with a minimum grade of D- or ARTG 3465 with a minimum grade of D-

**ARTG 3464. Topics In Experience Design Inquiry. (4 Hours)**

Focuses on a specific intermediate-level topic of timely relevance to the domain of experience design. May be repeated up to two times for a maximum of 12 semester hours.

**Prerequisite(s):** ARTG 3462 with a minimum grade of D-

**ARTG 3467. Paper Mechanics and Package Design. (4 Hours)**

Links paper, widely used in packaging, to work done by designers in systems of production, consumption, waste, and natural ecologies. Examines the ethical, social, and environmental responsibilities in the design of mass-produced objects and the role of paper in sustainability initiatives as a substitute for plastics. Uses design methods for material exploration, prototyping, and evaluation to deliver rich experiences. Offers students an opportunity to learn how to assess the impact of design decisions by following design through the stages of a packaging system: manufacturing, storage, merchandising, use, and product end-of-life.

**Prerequisite(s):** ARTG 2242 with a minimum grade of D- or ARTG 2252 with a minimum grade of D- or ARTG 2400 with a minimum grade of D- or ARTG 3462 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**ARTG 3470. Topics in Typographic Inquiry. (4 Hours)**

Builds upon basic typographic skills and knowledge to extend, expand, and deepen the student's understanding of the full range of possibilities for typographic expression as text, image, and experience of a reader. Challenges students to engage with letterform across historical and cultural practices of writing in a wide range of media. Examines how to identify the derivation and significance of writing styles by analyzing typographic form, composition, and presentation to the reader in a variety of contexts. Requires students to experiment with alphabets, fonts, and letterform as systems of signs with semiotic, semantic, logical, grammatical, and syntactical possibilities. Employs conceptual thinking, observation, analysis, and synthesis to devise and implement original ideas in various media.

**Prerequisite(s):** (ARTG 1290 (may be taken concurrently) with a minimum grade of D- ; ARTG 1291 with a minimum grade of D- ) or (ARTG 2250 (may be taken concurrently) with a minimum grade of D- ; ARTG 2251 with a minimum grade of D- )

**ARTG 3700. Interaction Design 2: Mobile. (4 Hours)**

Explores user-centered interface design for information exchanges using handheld and mobile devices. Studies the potentials for leveraging both the social and locative possibilities of mobile devices through research, discussions, and project assignments.

**Prerequisite(s):** ARTG 2400 with a minimum grade of D-

**ARTG 3810. Topics in Creative Fabrication Inquiry. (4 Hours)**

Introduces topic-specific creative fabrication processes appropriate for the creation of three-dimensional form. Possible topics include wearable technology, soft sculpture, toy design, and inflatables. Focuses on making as a pragmatic and unconventional approach to creative research. Offers students an opportunity to refine physical making skills and conceptually explore materials, tools, and sustainable processes to develop a personal design approach in response to the course topic. Introduces design for manufacturability concepts and contextualizes work drawing from sustainable design frameworks. May be repeated twice.

**Prerequisite(s):** (ARTF 1124 (may be taken concurrently) with a minimum grade of D- ; ARTF 1125 with a minimum grade of D- ) or (ARTF 1230 (may be taken concurrently) with a minimum grade of D- ; ARTF 1231 with a minimum grade of D- )

**Attribute(s):** NUpath Creative Express/Innov

**ARTG 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTG 4550. Design Degree Project. (4 Hours)**

Encompasses the proposal and execution of a comprehensive project in graphic, interaction, or experience design. Guides students in practical, hands-on implementation of contemporary design methods, as individuals or small interdisciplinary teams. Offers students an opportunity to develop an actionable design proposal and complete a polished project using appropriate design methods, as well as the opportunity to deepen understanding of the ways of knowing through design practice. Serves as a culmination to the undergraduate program.

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov

**ARTG 4554. Typography 3. (4 Hours)**

Offers an advanced course exploring a variety of typographical solutions, including expressive formal and complex content-based projects.

**Prerequisite(s):** ARTG 3350 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**ARTG 4555. Graphic Design Synthesis. (4 Hours)**

Offers students experience in the design of identity, information, persuasive messaging, and publication projects. Focuses on cross-platform (print, digital, and three-dimensional) manifestations—all based on a single area of content.

**Prerequisite(s):** ARTG 3350 with a minimum grade of D- ; (ARTG 3450 with a minimum grade of D- or ARTG 3452 with a minimum grade of D- )

**ARTG 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTG 5000. Topics in Design. (1-4 Hours)**

Explores a variety of key topics in design, including historical and cultural models. Taught by faculty on topics related to their research and expertise. May be repeated three times for a maximum of 16 semester hours.

**ARTG 5100. Information Design Studio 1: Principles. (4 Hours)**

Explores the theories and practices of information design through studio projects. Investigates visual systems and information structures such as maps, timelines, charts, and diagrams. Emphasizes the creative process of organizing, visualizing, and communicating data by seeking to make complex information easier to understand and use. Requires graduate standing or permission of program coordinator or instructor.

**ARTG 5110. Information Design History. (4 Hours)**

Investigates the history of visualization practices across disciplines and in relation to technology developments. Critically examines seminal visualizations in social, cultural, and technological contexts by means of discussions and writing activities in a seminar format. Requires graduate standing or permission of program coordinator or instructor.

**ARTG 5120. Research Methods for Design. (4 Hours)**

Examines qualitative and quantitative research methods pertinent to design. Through discussion and writing activities, offers students an opportunity to investigate varied inquiry toward the development of researchable questions, argument formation, and assessment methodologies. Students who do not meet course restrictions may seek permission of instructor.

**ARTG 5130. Visual Communication for Information Design. (4 Hours)**

Explores graphic and typographic theory, principles, and practices. Introduces students to visual communication design with a primary focus on typography as the fundamental means of conveying content. Readings locate design and typography within the larger history of visual art and writing development. Covers methods of organizing content through hierarchy and spatial organization of grid structures. Considers relationships between positive and negative space, depth perception, transparency, and color theory. Requires graduate standing or permission of program coordinator or instructor.

**ARTG 5150. Information Visualization Principles and Practices. (3 Hours)**

Introduces information visualization from theoretical and practical perspectives. Defines the information visualization domain and advances principles and methods for the effective visual representation of data. Contextualizes the field from a historical perspective. Presents the perceptual and cognitive tasks enabled by visualizations. Studies an extensive range of visualization models. Illustrates good and bad practices in visualization with real-world examples. Introduces concepts in computer programming in an information visualization context.

**ARTG 5151. Information Design Critique Seminar. (1 Hour)**

Requires students to present their work in design critique sessions to peers, faculty, and guests. Through these critiques, offers students an opportunity to improve their projects based on feedback, learn how to present their work effectively, and articulate design problems in verbal discourse. Can only be taken in conjunction with ARTG 5150.

**Prerequisite(s):** ARTG 5150 (may be taken concurrently) with a minimum grade of C or ARTG 5150 (may be taken concurrently) with a minimum grade of C

**ARTG 5310. Visual Cognition. (4 Hours)**

Introduces human visual cognition as it applies to information design and visualization. Focuses on perception, attention, pattern recognition, information acquisition, memory, and creation of mental models. Explores reasoning, cognition, decision making, and problem solving in relation to visual artifacts. Students who do not meet course restrictions may seek permission of instructor or program coordinator.

**ARTG 5320. Statistics for Design. (4 Hours)**

Offers design students an opportunity to obtain the necessary skills to collect, summarize, analyze, and interpret data. Introduces concepts and methods in statistical reasoning and analysis. Topics include data mining, comparison, assessment, and delivery. Students who do not meet course restrictions may seek permission of instructor or program coordinator.

**ARTG 5330. Visualization Technologies 1: Fundamentals. (4 Hours)**

Introduces programming languages that allow computational analysis and digital delivery of dynamic information. Examines implications of environmental and personal sensor data sources, mobile collection and analysis of data, real-time networked data sets, and social use of shared data visualization tools. Students who do not meet course restrictions may seek permission of instructor or program coordinator. May be repeated once.

**ARTG 5430. Visualization Technologies 2: Advanced Practices. (4 Hours)**

Builds on the foundational skills acquired in ARTG 5330. Introduces students to intermediate- to advanced-level topics in web-based interactive visualization. Focuses on building greater proficiency in working with d3 and related JavaScript libraries and on acquiring knowledge of best practices and common patterns in data visualization problem solving. Through lectures, workshops, and a final project, offers students an opportunity to learn to effectively deploy their data visualization skills to explore and extract understanding from data in a critical and productive way.

**Prerequisite(s):** ARTG 5330 with a minimum grade of C- or ARTG 5330 with a minimum grade of D-

**ARTG 5540. Design and Product Management. (1 Hour)**

Explores the principles of user research, delving into techniques for gathering and analyzing user insights to inform design decisions. Applies the human-centered design process to address real-world challenges, balancing user needs, business objectives, and technological possibilities. Explores innovation strategy, using tools and frameworks to generate creative solutions and drive meaningful change in product development. Covers the practical skills necessary to navigate complex design problems and contribute effectively to cross-disciplinary teams in the professional world.

**ARTG 5600. Experience Design Studio 1: Principles. (4 Hours)**

Offers students hands-on project development of systems, artifacts, communication, environments, or service offerings with a focus on the unique personal experience of the audience exposed to the project. Experience design is a holistic approach to design that investigates the human experience in specific situations to improve its quality, given an understanding of human goals, needs, and desires. This course provides a context for a cohesive experience through interaction, movement, and understanding, which builds on previous knowledge of audiences and applications. Presents students with design methods and processes for experience design by developing a semester-long project. Offers students an opportunity to develop competency in tools used to create the various elements that create the context for experiences in specific situations and events including interaction, artifact, and environment design. Understanding a design process and knowledge of studio critique practices is recommended.

**ARTG 5610. Design Systems. (4 Hours)**

Explores a systems-based perspective on our environment by addressing questions that are fundamental to design practice: What is a system, and what are the different types? How do we observe, analyze, and represent systems? What interactions can we have with systems and what are the different types of interaction? Explores structures and processes for the design of systemic relationships between people, artifacts, environments, and activities. Systems may be physical, virtual, social, or a combination. Through discussion, writing, diagramming, and project exercises, offers students an opportunity to learn principles of systems theory and explore the connection between design methods and systems thinking. Students who do not meet course restrictions may seek permission of instructor or program coordinator.

**ARTG 5620. Notational Systems for Experience. (4 Hours)**

Examines theoretical foundations, concepts, and methods of visual notational systems used in the effective analysis and communication of existing experiences and in the envisioning of conditions for future experiences. Notational systems are sets of graphic signs and codes that denote or prescribe specific actions, forces, operations, events, or performances that occur over time. Students engage with concepts and models through readings, discussion, case study analyses, and speculative design projects. Evaluates the role that notational systems play in documenting, analyzing, and understanding the human goals, actions, behaviors, and perceptions key to experience and assesses their value in designing for agency and new experiences. Students who do not meet course restrictions may seek permission of instructor or program coordinator.

**ARTG 5640. Prototyping for Experience Design. (4 Hours)**

Explores tools, technologies, and processes to create prototypes of artifacts, environments, and interactive systems for experience design projects. Offers students the opportunity to learn, use, experiment with, and test prototypes using a wide range of state-of-the-art prototyping technologies to further their understanding of multiple strategies and techniques of prototyping for experience design. Tools and techniques change over time but typically include laser cutting, 3D printing, CNC machining, electronics prototyping, augmented reality, machine tools and 2D forming, fast prototyping, and hand tools.

**ARTG 5710. Design for Dignity. (4 Hours)**

Explores the ethical dimensions of design practice through design projects. This studio course addresses design problems with a focus on the concept of dignity as a central principle of human-centered design. Uses readings and in-class activities to study human value systems, dignity as a principle, and service design as a process of deliberation. Offers students an opportunity to practice applying these perspectives, models, and theories to create compelling design projects as well as to develop competencies in collective participation in community.

**ARTG 5910. Human-Centered Design. (4 Hours)**

Introduces human-centered design and associated ways of thinking and working. Human-centered design places people at the center and can be used to develop many types of interventions. Aims to foster understanding of people's lived experiences and identify their needs and pain points through extensive user research, iterative testing, and close interaction with the intended audience and relevant stakeholders. That understanding informs and gives direction to the design process and decisions made along the way to ensure that the final intervention benefits its intended users.

**ARTG 6100. Information Design Studio 2: Dynamic Mapping and Models. (4 Hours)**

Continues the exploration of data representations in a variety of media. Focuses on interactive and time-based techniques. Emphasizes computational methods of data collection, manipulation, and encoding. Requires graduate standing or permission of program coordinator or instructor. May be repeated once.

**Prerequisite(s):** ARTG 5100 with a minimum grade of D- or ARTG 5100 with a minimum grade of C- (Graduate)

**ARTG 6110. Information Design Theory and Critical Thinking. (4 Hours)**

Examines various theoretical models of information visualization and delivery systems. Evaluates the concepts and effectiveness of the models through discussions and writing activities. Students who do not meet course prerequisites or restrictions may seek permission of program coordinator or instructor.

**Prerequisite(s):** ARTG 5100 with a minimum grade of C-

**ARTG 6310. Design for Behavior and Experience. (4 Hours)**

Examines the potential of interfaces as mediators between information and users. Explores iterative prototyping and research methods to analyze patterns of behavior and implications of interface on effective communication. Utilizes observation, empathy, ethnography, and participatory design methods to offer students an opportunity to increase their understanding of audiences' and stakeholders' motivations and expectations. Requires graduate standing or permission of program coordinator or instructor.

**ARTG 6330. Information Design Mapping Strategies. (4 Hours)**

Examines the relationships between content and context through mapping methods. Emphasizes the impact of geographic information systems, evolving technologies, community mapping tools, globalization, and delivery systems. Undergraduate students may seek permission of instructor.

**ARTG 6460. Human-Centered AI. (4 Hours)**

Explores the foundations of human-centered AI. Examines the critical processes underpinning AI development and deployment and applies user-centered design principles to AI-driven products and services. Investigates methodologies for integrating human perspectives into AI systems and strategies for fostering collaboration between AI technologies and human users. Analyzes the ethical implications of AI applications in various organizational contexts using case studies showcasing the diverse uses of AI across business processes and products. Offers students an opportunity to engage in hands-on projects to design AI solutions tailored to human needs and that use AI systems responsibly to prioritize human values and well-being. Critically assesses the societal impacts of human-centered AI adoption.

**ARTG 6555. Graphic Design Synthesis. (4 Hours)**

This course has been designed for graduate students in the Information Design and Visualization program. It builds on skills obtained in the ARTG 5100 Information Design Studio: Principles course. The course is intended to give the students experience in the design of identity, information, and publication projects, as well as focus on cross-platform (print, digital, and three-dimensional) manifestations – all based on a single area of content. Its scope reflects the multi-faceted components that comprise real-world comprehensive design projects. Through additional research and readings, students are to perform at high level, and demonstrate how the readings of theoretical material reflect in their projects. Information and Design Visualization graduate students, or permission of the teacher.

**ARTG 6600. Experience Design Studio 2: Group and Interpersonal. (4 Hours)**

Offers students an opportunity to learn a human-centered design perspective and to develop experience design competency in the complex context of interpersonal and group interactions. Experience design is a holistic approach that investigates the human experience in specific situations in order to improve its quality. Students study the person-to-person aspect of human-centered design through readings and in-class activities, as well as practice applying its perspectives, models, and theories to the project process. Students are asked to participate in class discussions and create compelling experience design projects to address the needs, desires, fears, and aspirations of their audience.

**Prerequisite(s):** ARTG 5600 with a minimum grade of C-

**ARTG 6700. Design Studio 3: Synthesis. (4 Hours)**

Extends the exploration of design principles and methods by starting the development of a design master thesis. Examines how to develop effective design interventions capable of enriching human experience in specific situations, sites, and in the context of comprehensive activities. Emphasizes a systems perspective in both research and design development—the relationships between diverse participant groups and communities as well as the complex implications and interrelations of interventions at multiple scales and dimensions. Continues the exploration of theories of information design and visualization. Offers students an opportunity to prototype functioning applications that advance their thesis projects.

**Prerequisite(s):** ARTG 6100 with a minimum grade of C- or ARTG 6600 with a minimum grade of C-

**ARTG 7100. Critical Design and Research Seminar. (4 Hours)**

Examines emerging research and critical practices in design. Provides conceptual frameworks to formalize and iterate on students' thesis topics. Presents and frames qualitative research methods for application in thesis research. Offers students an opportunity to develop the visual and verbal expression of the thesis through writing, discussion, presentation, and critique, resulting in a thesis proposal document and in a public presentation for faculty feedback.

**ARTG 7890. Thesis. (4 Hours)**

Offers students an opportunity to obtain the support needed to develop and produce the written component of a design thesis that integrates and applies their knowledge acquired during the program. Encourages student participation within a practice and research community consisting of classmates, advisor(s), and external professionals.

**Prerequisite(s):** ARTG 5120 with a minimum grade of C- ; ARTG 6100 with a minimum grade of C-

**ARTG 7910. Design Project and Exhibition. (4 Hours)**

Offers students an opportunity to focus on the design of pieces, artifacts, and experiences for the thesis exhibition. Includes planning and design of the exhibit. Situates the thesis contributions to design as project-based discipline. Discusses and reflects on the design process at the crossroads of methodological, systematic iteration, and creative exploration.

**Prerequisite(s):** ARTG 7990 (may be taken concurrently) with a minimum grade of B-

**ARTG 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**ARTG 7990. Thesis. (4,8 Hours)**

Offers students support in developing and producing the written component of a design thesis that integrates and applies their accumulated knowledge. Encourages student participation within a practice and research community consisting of classmates, advisor(s), and external professionals. Restricted to students in experience design and Information design and visualization.

**ARTG 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers students continuing thesis supervision by members of the department.

**Art - Fundamentals (ARTF)****ARTF 1000. Art and Design at Northeastern. (1 Hour)**

Introduces students to the intellectual and extracurricular opportunities within the Department of Art + Design and the College of Arts, Media and Design. Exposes students to the cultural vibrancy of Boston with the goal of building networks that facilitate a supportive learning community. Familiarizes students with their major and introduces them to the resources at the university and across the city to help them succeed academically. Provides grounding in the culture and values of the university community and seeks to help students develop interpersonal skills.

**ARTF 1120. Observational Drawing. (4 Hours)**

Focuses on developing an understanding of the structure of object and figure through freehand drawing. Offers students an opportunity to explore a wide range of materials, including wash, charcoal, and pencil.

**Attribute(s):** NUpath Creative Express/Innov

**ARTF 1121. Conceptual Drawing. (4 Hours)**

Seeks to expand the student's knowledge and skills through a mark-making process. Offers students an opportunity to begin to understand the relationship between form and meaning while relating the drawing process to broader concepts of communication.

**Attribute(s):** NUpath Creative Express/Innov

**ARTF 1122. Color and Composition. (4 Hours)**

Offers an opportunity to discover and research basic principles, language, and concepts inherent in two-dimensional visual systems. Offers students an opportunity to learn to think critically, analyze, and apply basic principles to design and art projects. In a studio workshop setting, three primary phases explore art, design, and photography.

**Attribute(s):** NUpath Creative Express/Innov

**ARTF 1123. Color and Composition Tools. (1 Hour)**

Introduces skills and software, such as Adobe Photoshop and Illustrator, used in creating and manipulating pixel- and vector-based images, in a technology workshop format.

**Prerequisite(s):** ARTF 1122 (may be taken concurrently) with a minimum grade of D-

**ARTF 1124. Form and Structure. (4 Hours)**

Explores three-dimensional form. Examines principles including mass, volume, line, plane, and texture. Introduces basic materials and structure through constructing models and prototypes. Presents sequential exercises with simple eye/hand skills and form recognition. Explores complex projects that require an understanding of context, content, and developing original forms.

**Corequisite(s):** ARTF 1125

**ARTF 1125. Form and Structure Tools. (1 Hour)**

Introduces skills and software used in creating 3D forms with the computer. Explores basics of 3D modeling, surfacing, lighting, and rendering in this technology workshop.

**Corequisite(s):** ARTF 1124

**ARTF 1200. Representational Drawing. (2 Hours)**

Introduces the fundamental tools and techniques of representational drawing as a means of rendering 3D objects and spaces in the physical environment onto a 2D surface. Structured exercises offer students an opportunity to practice the act of seeing and drawing utilizing the techniques of positive and negative space, formal one- and two-point perspective, observed perspective, organizational lines, sighting, and value.

**Attribute(s):** NUpath Creative Express/Innov

**ARTF 1210. Abstract Drawing. (2 Hours)**

Introduces the fundamental tools and techniques of conceptual drawing to represent abstract concepts and information. Applies contemporary art and design practices to explore physical mark making and to better understand the relationship between form and content.

**Attribute(s):** NUpath Creative Express/Innov

**ARTF 1220. Elements of Visual Composition. (2 Hours)**

Introduces the fundamental principles and materials of 2D art and design. Emphasizes visual concepts of balance, rhythm, pattern, emphasis, contrast, unity, movement, line, shape/form, space, value, color, and texture. Studio experimentation offers students an opportunity to practice composition and color theory as it applies to 2D art and design.

**Attribute(s):** NUpath Creative Express/Innov

**ARTF 1221. Elements of Visual Composition Tools. (0 Hours)**

Introduces 2D art and design software including Adobe Photoshop, Adobe Illustrator, and Adobe InDesign.

**Prerequisite(s):** ARTF 1220 (may be taken concurrently) with a minimum grade of D-

**ARTF 1230. Making with Form and Materials. (2 Hours)**

Introduces concepts, processes, and studio practice in 3D making. Examines the elements and principles of 3D making, including mass, volume, line, plane, and texture. Hands-on experimentation offers students an opportunity to develop skills to define 3D form, express ideas through it, and solve visual problems. Students experiment with additive, subtractive, and substitutive material processes while leveraging both traditional craft techniques and digital fabrication. Focuses on developing a practical understanding of the relationship between material, form, function, aesthetic and context, and a vocabulary to successfully articulate concepts and insights during discussions and critiques.

**Corequisite(s):** ARTF 1231

**Attribute(s):** NUpath Creative Express/Innov

**ARTF 1231. Making with Form and Materials Tools. (0 Hours)**

Introduces a range of tools and industry-standard software for creating 3D forms and making. Offers students an opportunity to learn about file setup and safe operation of basic wood shop tools, CNC laser cutters, and 3D printers. Focuses on the unique affordance of each tool to enable students to creatively experiment with these processes. Covers the basics of 3D modeling and vector drawing and making.

**Corequisite(s):** ARTF 1230

**ARTF 1240. Making with Video, Sound, and Animation. (2 Hours)**

Introduces the fundamental tools and techniques of lens-based and time-based art and design principles and materials. Applies visual principles of movement, point of view, time, repetition, sequencing, sound, and space to create video and film compositions.

**Corequisite(s):** ARTF 1241

**Attribute(s):** NUpath Creative Express/Innov

**ARTF 1241. Making with Video, Sound, and Animation Tools. (0 Hours)**

Focuses on developing an understanding of, and dexterity with, movement- and time-based media and software—including After Effects—to create motion graphics, short animations, video, and montage-style films.

**Corequisite(s):** ARTF 1240

**ARTF 1250. Designing Interactive Experiences. (2 Hours)**

Introduces the language, concepts, and processes of interactive experience as a compelling medium to communicate meaning. Examines how variables within the environment can change how we inhabit an experience physically, conceptually, and emotionally and affect or provoke responses. Hands-on experimentation offers students an opportunity to learn using one or more forms of rapid prototyping. Studies historical and contemporary examples of art and design projects designed as exchanges or experiences. Incorporates visual and nonvisual mapping techniques as a means to understand the present.

**Corequisite(s):** ARTF 1251

**Attribute(s):** NUpath Creative Express/Innov

**ARTF 1251. Designing Interactive Experiences Tools. (0 Hours)**

Introduces wireframing and industry-standard tools and software for creating basic web-based content using HTML and CSS. Offers students an opportunity to create a portfolio website for showcasing projects created in ARTF 1250.

**Corequisite(s):** ARTF 1250

**ARTF 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTF 2220. Movement and Time. (4 Hours)**

Explores time-based art and design in an introductory lecture/studio format. Introduces formal, narrative, and alternative concepts for creative time-based communication. Assignments investigate video, animation, and a mixture of media in a screen based context.

**Corequisite(s):** ARTF 2221

**Attribute(s):** NUpath Creative Express/Innov

**ARTF 2221. Movement and Time Tools. (1 Hour)**

Introduces skills and software used in animating 2D and 3D images, graphics, and forms. Explores the basics of key framing, layering, parenting, 3D modeling, surfacing, and rigging in this technology workshop.

**Corequisite(s):** ARTF 2220

**ARTF 2223. Experience and Interaction. (4 Hours)**

Explores the language of interactive experience as a compelling medium to communicate meaning. Examines how variables within the environment can change how we inhabit an experience physically, conceptually, and emotionally. Studies historical and contemporary examples of art and design projects designed as exchanges or experiences. Incorporates drawing as a means to understand the present and project potential future experiences.

**Corequisite(s):** ARTF 2224

**Attribute(s):** NUpath Creative Express/Innov

**ARTF 2224. Experience and Interaction Tools. (1 Hour)**

Introduces skills and software used in creating basic Web-based content. This technology workshop introduces software using HTML and style sheets such as Adobe Dreamweaver.

**Corequisite(s):** ARTF 2223

**ARTF 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTF 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTF 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Art - General (ARTE)

### ARTE 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### ARTE 2301. The Graphic Novel. (4 Hours)

Explores the word-and-image medium of comics as a narrative form. Focuses on the contemporary phenomenon of the so-called graphic novel. What are the preoccupations of today's graphic novels? How does their storytelling work? Some work in translation is included, but the course largely concentrates on the American tradition, focusing on fiction, memoir, and nonfiction reporting and adaptation. Offers students an opportunity to learn practices of reading—and making—comics. Emphasizes the formal language, or grammar, of comics in order to interpret its narrative procedure and possibilities.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

### ARTE 2500. Art and Design Abroad: Studio. (4 Hours)

Offers an intensive studio course taken abroad and taught by an art and design faculty member. Exposure to regional artists, history, culture, museums, architecture, and physical geography provide focus of study and creative exploration. May be repeated without limit.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

### ARTE 2501. Art and Design Abroad: History. (4 Hours)

Offers an intensive history course taken abroad and taught by an art history, design, or art faculty member. Exposure to regional and international artists, history, culture, museums, landscape architecture, galleries, material culture, and architecture provide a rich context for studying the history of art and design. Offers students an opportunity to understand narrative and visual components through detailed hands-on workshops and detailed creation of artistic formats, including design, text essays, photographic essays, temporary exhibitions, video art projections, and live performances as artifacts. May be repeated without limit.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

### ARTE 2990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### ARTE 2991. Research in Art and Design. (1-4 Hours)

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision.

### ARTE 3901. Art and Design Special Topics. (4 Hours)

Offers an art and design course in which format and content are determined by the instructor. May be repeated up to five times.

### ARTE 3990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### ARTE 4901. Special Topics in Art and Design Studio. (4 Hours)

Offers an art and design studio in which format and content are determined by the instructor. May be repeated up to five times.

### ARTE 4970. Junior/Senior Honors Project 1. (1-4 Hours)

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated up to five times.

### ARTE 4990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTE 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**ARTE 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated up to five times.

**Attribute(s):** NUpath Integration Experience

**ARTE 4996. Experiential Education Directed Study. (4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major. Restricted to those students who are using it to fulfill their experiential education requirement. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**ARTE 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTE 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**ARTE 6976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated up to four times.

**ARTE 6984. Research. (1-4 Hours)**

Offers students an opportunity to conduct research under faculty supervision. May be repeated up to four times.

**ARTE 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**ARTE 7990. Thesis. (4 Hours)**

Offers the candidate, working with a thesis advisor, an opportunity to continue to complete the research project defined and proposed in ARTE 7100. The research is carried out in an independent manner, with periodic presentations to the thesis committee. These presentations define the benchmarks for determination of successful progress in the project. The ultimate result is an exhibition, screening, performance, or other form of public display or presentation, together with a thesis paper or written corollary.

**Prerequisite(s):** ARTE 7100 with a minimum grade of C-

**ARTE 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers continued work on the thesis project.

**Prerequisite(s):** ARTE 7990 with a minimum grade of C-

## Art - History (ARTH)

### ARTH 1001. Visual Intelligence. (2 Hours)

Examines via interdisciplinary lectures how image technologies and techniques of perception endemic to visual art, popular culture and digital media shape how visual culture is understood within an expanding knowledge economy. Introduces analytical skills of observation and methods of contextual analysis (materialism, semiotics, feminisms, LGBTQ studies, queer theory, theories of decolonization and disability studies), in order for students to develop compelling interpretations of visual phenomena within a shifting global context. Visual Intelligence explains how visual studies connects to the fields of law, design, publishing, curating, conservation, and other areas of knowledge production.

**Corequisite(s):** ARTH 1002

**Attribute(s):** NUpath Interpreting Culture

### ARTH 1002. Seminar in Visual Intelligence. (2 Hours)

Accompanies ARTH 1001. Fosters in-depth discussion, allows for hands-on workshops and facilitates visits to area museums and cultural organizations. Emphasizes the ways digital image technologies are socially constructed and are based on earlier paradigms of classification and differentiation. Seminar meetings demonstrate how to critically read a range of images (e.g. texts, films, videogames, memes, artworks) by paying attention to the ways meaning is often shaped by identitarian formations such as race, gender, sexual orientation, class, and ability. Investigates how diverse perspectives enhance the ability to create, while introducing students to creative professionals who actively use visual intelligence in their dynamic careers.

**Corequisite(s):** ARTH 1001

### ARTH 1100. Interactive Media and Society. (4 Hours)

Offers a critical historical survey of interactive media from analog to digital techniques and from physical to virtual spaces. Offers students an opportunity to examine the social, ethical, and cultural impact of interactive media and to implement design projects addressing current issues and directions in interactive media. Considers a wide range of current and historical aspects of interactive media and design through weekly lectures, artistic research projects, and critical analyses.

**Attribute(s):** NUpath Writing Intensive

### ARTH 1110. Global Art and Design History: Ancient to Medieval. (4 Hours)

Investigates the history of painting, sculpture, design, and related arts through a study of masterpieces from prehistoric times to the end of the Middle Ages. Offers students an opportunity to become familiar with specific works, styles, and terminology of art and design and to develop an ability to communicate about the visual arts.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

### ARTH 1111. Global Art and Design History: Renaissance to Modern. (4 Hours)

Explores the evolving history of visual art and architecture from 1300 through the 20th century. Combines integrated modules and activities together with observation and analysis of art and architecture, with the goal of interpreting cultures and understanding societies. Offers students an opportunity to learn specific works, styles, and specialized terminology, thereby developing an ability to communicate about the visual arts.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

### ARTH 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### ARTH 2200. Topics in Design History. (4 Hours)

Explores various design history topics through pioneering designers whose work has influenced contemporary design culture. Instructor determines format and content.

### ARTH 2210. Modern Art and Design History. (4 Hours)

Surveys modernist movements from early to mid-20th century. Emphasizes the reciprocal evolution of art and design within cultural and social contexts.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions, NUpath Writing Intensive

**ARTH 2211. Contemporary Art and Design History. (4 Hours)**

Offers a study of contemporary culture in an art and design survey from mid-twentieth century to present. Presents a thematic approach to late-modern and postmodernist movements, focusing on interrelationships among media.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**ARTH 2212. Survey of the Still and Moving Image. (4 Hours)**

Examines the history of still and moving images in relationship to other artistic, documentary, and journalistic practices.

**ARTH 2215. History of Graphic Design. (4 Hours)**

Follows a chronological survey of graphic design from 4000 BC to the beginning of the 21st century, emphasizing work from 1880 to 2000, and the relationship of that work to other visual arts and design disciplines. Demonstrates how graphic design has responded to (and affected) international, social, political, and technological developments since 1450. Traces developments in the areas of typography and publication, persuasion, identity, information, and theory.

**ARTH 2311. The Science of Art, the Art of Science. (4 Hours)**

Explores the intersection of science and the arts as both ways of 'knowing', and how, during their development they have shared many techniques and approaches. Considers areas such as botany, anatomy, cartography, engineering, perspective and ecology relation to both science and art, arguing that observation, imagination, and invention were fundamental to both pursuits. Investigates the cultural conditions at the heart of the common cultural trope, "Renaissance Man". Focuses on two components of observation, drawing and writing, both important techniques of the early modern artist and scientist.

**Attribute(s):** NUpath Interpreting Culture

**ARTH 2312. Revolutionary Design and Propaganda in Eastern Europe. (4 Hours)**

Introduce students to significant and influential movements in Eastern European art and design history, such as Suprematism, Constructivism, Productivism, Socialist Realism and Nonconformist art, and explores both the ways in which art was instrumentalized by the Soviet state and the ways in which artists reacted against that instrumentalization in later years. By analyzing posters, costume and set designs, socialist realist paintings, and performances, and creating them themselves, students understand the ways in which artists sought to become producers and create work that perfectly embodied the burgeoning socialist state, and later used coded language to create work that reacted against that increasingly failing state.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**ARTH 2313. Global Networks in Early Modern Art and Visual Culture. (4 Hours)**

Presents case studies exploring histories, interpretations, and reception of diverse global art, design, architecture, and visual culture and their embeddedness in circuits of global trade, migrations, pilgrimage, exile, colonialism, and the movements of diasporas before 1900. Considers the role of the artist and artisan and types of creative agency in the construction and maintenance of empires, in ritual practice, and in Indigenous resistance. Emphasizes intermixed image cultures produced by intercultural contact and tracks the movement of materials and visual culture around the globe. Describes and critiques the agency of global visual cultures to reflect and produce identities. Examines and compares the cultural and social functions of art and its ties to global goods and resources and art materials.

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**ARTH 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTH 3000. Topics in Visual Studies. (4 Hours)**

Explores a variety of topics in visual studies, including historical and cultural models. Taught by faculty according to their research interests and expertise. May be repeated up to six times.

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**ARTH 3211. Performance Art. (4 Hours)**

Examines the development and significance of performance art globally, from its prehistory in the early 20th century, to its heyday in the 1960s and 1970s, through to the present day. Examines the history and theory of performance art and engages with the genre through making and reflecting on students' experiences of knowing the artwork "from the inside".

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture, NUpath Writing Intensive

**ARTH 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTH 4000. Topics in Visual Studies. (4 Hours)**

Explores a variety of advanced topics in visual studies, including historical and cultural models. Taught by faculty according to their research interests and expertise. May be repeated five times.

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**ARTH 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTH 5600. Landscape and Ecology in Visual Culture. (4 Hours)**

Offers critical and historical approaches to landscape, nature, ecology, and human subjectivity in art, design, and visual culture up to the present day, drawn from the interdisciplinary environmental humanities. Ecocritical art history is a growing field that examines and critiques the agency of creative visual production to represent, narrate, innovate, and transform our relationship to the natural world.

**ARTH 6211. Advanced Performance Art. (4 Hours)**

Focuses on the history and theory of performance art from the early 20th century to the present day. Engages students in self-directed research on a performance artist and related performance theories and application of that research to a performance of their own. Students evaluate and analyze their own work in relation to historical works of performance and offer evidence-based support for their production.

**ARTH 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTH 6976. Directed Study. (1-4 Hours)**

Offers directed study of a specific topic not normally contained in the regular course offerings but within the area of competence of a faculty member. May be repeated without limit.

**Art - Media Arts (ARTD)****ARTD 1001. Media Art, Culture, and Social Justice. (2 Hours)**

Introduces a wide range of perspectives on and practices of media art and social justice. Exposes students to key concepts, lineages, controversies, and consequences of media practices that expose injustice and seek to build a more equitable and sustainable world. Positions media arts as an intersectional and interdisciplinary practice connecting racial, gender, technological, and spatial/environmental justice. Also serves as an introduction to this dynamic and growing field of professional practice, with illustrative case studies that include interdisciplinary creative work by CAMD faculty as well as leading international practitioners.

**Corequisite(s):** ARTD 1002

**Attribute(s):** NUpath Difference/Diversity, NUpath Ethical Reasoning

**ARTD 1002. Seminar for ARTD 1001. (2 Hours)**

Accompanies ARTD 1001. Discusses and directly applies ideas and practices. Offers students an opportunity to articulate their own positions on critical issues by participating in a range of engaging in-class and research activities.

**Corequisite(s):** ARTD 1001

**ARTD 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTD 2000. Introduction to Immersive Media. (4 Hours)**

Introduces three forms of immersive media—augmented reality, 360 video, and virtual reality—through engagement in content creation, the fundamentals of software tools, development methodologies, and production techniques. Offers students an opportunity to produce basic immersive sequences, read literature, play games, and experience contemporary projects that highlight the uniqueness of immersive media.

**ARTD 2100. Narrative Basics. (4 Hours)**

Explores narrative sequence and story development in a variety of story architectures and media combinations, including text, video, music, audio, and design. Uses lectures, in-class workshops, and collaborative projects to expose students to the critical role of narrative in society and interactive media, including games. Offers students an opportunity to develop an interactive media design document over the second half of the semester.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**ARTD 2340. Introduction to Computational Creative Practice. (4 Hours)**

Examines concepts of computational creative practices, focusing on the use of computational processes for the creation of interactive and generative experiences. Includes computational procedures and concepts for creative purposes such as automation, recursion, and data processing. Students use data and mathematical procedures to generate images, express ideas, and create meaning. Offers students an opportunity to gain practice-based experience with the benefits and limitations of using computational processes; make creative computational projects using code and/or other media such as photography, video, performance installation, etc.; and reflect on what computers can and cannot do well.

**ARTD 2360. Introduction to Photography. (4 Hours)**

Introduces creative photography, exploring techniques and processes starting with the basic principles of camera controls, lens and lens functions, digital image presentation basics, as well as photographic seeing and visual thinking. Evaluates and expands technical and conceptual knowledge of the medium. Beyond the technical foundation of digital image making, analyzes various theories and understanding of ways of seeing photographically. Culminates in a final project and presentation designed to demonstrate the importance of technical expertise, editing, sequence, layout, and presentation of ideas.

**Corequisite(s):** ARTD 2361

**Attribute(s):** NUpath Creative Express/Innov

**ARTD 2361. Photo Tools. (1 Hour)**

Introduces students to the creative possibilities of photographic image editing and management with Adobe Bridge, Camera Raw, and Photoshop. Offers students an opportunity to establish a professional digital workflow, acquire industry-standard creative techniques for photographic image editing, and gain an understanding of the importance of high-quality postproduction output.

**Corequisite(s):** ARTD 2360

**ARTD 2370. Animation Basics. (4 Hours)**

Offers an introductory studio course that explores the creative potential of animation. Exposes students to a variety of traditional animation processes and techniques through lectures, demonstrations, and hands-on assignments. Provides an historical survey of animation art through the twentieth century. Emphasizes using the computer to develop concepts creatively while learning the fundamental skills of constructing animated images and forms.

**Prerequisite(s):** ARTF 1240 with a minimum grade of D- or ARTF 2220 with a minimum grade of D-

**Corequisite(s):** ARTD 2371

**Attribute(s):** NUpath Creative Express/Innov

**ARTD 2371. Animation Tools. (1 Hour)**

Introduces intermediate skills and software used in creating 3D animation. Explores modeling, surfacing, lighting, key framing, and rigging in this technology workshop.

**Corequisite(s):** ARTD 2370

**ARTD 2380. Video Basics. (4 Hours)**

Offers an introductory exploration into the moving image as an art form. Covers the fundamental technical and aesthetic aspects of contemporary video production. Emphasizes personal, experimental works from an individual point of view. Analysis of projects is directed toward the development of a personal voice.

**Prerequisite(s):** ARTF 1240 with a minimum grade of D- or ARTF 2220 with a minimum grade of D-

**Corequisite(s):** ARTD 2381

**ARTD 2381. Video Tools. (1 Hour)**

Introduces intermediate skills and software used in capturing, manipulating, and editing video and audio in this technology workshop.

**Corequisite(s):** ARTD 2380

**ARTD 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTD 3000. Topics in Media Arts. (1-4 Hours)**

Explores a variety of intermediate-level thematic topics in media arts, including photography, video arts, animation, immersive media, and computational media. Taught by faculty according to their research interests and expertise. Students who do not meet course restrictions may seek permission of instructor or program coordinator. May be repeated three times for a maximum of 16 semester hours.

**Prerequisite(s):** ARTD 2000 with a minimum grade of C or ARTD 2360 with a minimum grade of C or ARTD 2370 with a minimum grade of C or ARTD 2380 with a minimum grade of C

**ARTD 3460. Photography: Concept + Process. (4 Hours)**

Explores how process informs concept and vice versa, with a focus on making and photographic practice. Emphasizes creative projects, readings on contemporary photography, and the responses and presentations on the ideas brought forth by our investigations. Constructive critiques, which include investigation of the nuances of the medium and its uses, encourage confidence of creative abilities, vision, and independent thinking. Students use photographic concepts and creative techniques for the development, coordination, and completion of a final photographic body of work. Considers the politics of representation and contextual references and seeks to answer: Who is it of? Who is it for? What does it do? Who does it serve? This is an intermediate photography seminar.

**Prerequisite(s):** ARTD 2350 with a minimum grade of D- or ARTD 2360 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**ARTD 3470. Animation 1. (4 Hours)**

Introduces the fundamentals of three-dimensional computer animation. Class lectures and demonstrations are followed by substantial hands-on exploration. Students gain fundamental skills for modeling, surfacing, and animating. Projects progress from creating simple geometric objects to realistic organic characters. Basic systems for animating are introduced and explored.

**Prerequisite(s):** ARTD 2370 with a minimum grade of D-

**ARTD 3471. Virtual Environment Design. (4 Hours)**

Utilizes elements of story and game play in the design of both 2D and 3D environments, integrating architecture, landscape, and set dressing. Introduces real-time procedurally generated terrain and flora, asset optimization, and nonlinear path finding. Explores content ranging from historically accurate and contemporary hyperrealistic to stylized and fanciful.

**Prerequisite(s):** ARTF 1120 with a minimum grade of D- ; ARTD 2370 with a minimum grade of D-

**ARTD 3472. Character Design for Animation. (4 Hours)**

Focuses on the development of characters as they relate to game design and animation. Explores, through treatments and synopsis, theme-based character back story, rationale, and visual design. Integrates learning objectives of both 2D and 3D, optimized rigging, movement study, and accessory and prop design.

**Prerequisite(s):** ARTF 1120 with a minimum grade of D- ; ARTD 2370 with a minimum grade of D-

**ARTD 3473. Animation for Games. (4 Hours)**

Explores all areas of 3D game asset creation—animation, modeling, shading, effects, and their integration. Working in small groups, students have an opportunity to learn how to construct animated assets that work efficiently within a game programming environment. Encourages students to specialize in at least one area of asset creation.

**Prerequisite(s):** ARTD 3470 with a minimum grade of D-

**ARTD 3480. Video: Sound and Image. (4 Hours)**

Continues the study of video as an art form. Focuses on the dynamic relationship between sound and the moving image. Begins with audio exercises exploring various aspects of sound design that are integrated into an in-depth video production. Emphasizes the production of innovative video art with powerful visual imagery, complex editing rhythms, and creative sound design.

**Prerequisite(s):** ARTD 2380 with a minimum grade of D- or MSCR 1230 with a minimum grade of D-

**ARTD 3485. Experimental Video. (4 Hours)**

Constitutes an advanced video production and analysis course. Emphasizes the development of personal vision and building a working knowledge of contemporary experimental video art techniques. Offers students an opportunity to expand conceptual ideas and visual language skills by interrogating concepts of time, movement, light, and space within their exploratory working process. Visual research and discussion supplement the studio work.

**Prerequisite(s):** ARTD 2380 with a minimum grade of D- or MSCR 1230 with a minimum grade of D-

**ARTD 3490. Data Art and Hacktivism. (4 Hours)**

Explores the practices and politics of data collection and processing for creative and critical output. Studies how to collect online data with and without APIs and how to process textual data using Natural Language Processing techniques. Examines the practices currently used in social web technologies by making creative projects. Addresses the ethical issues of data collection and privacy, as well as the practical, technical, and social problems that can arise during the processing of social data.

**ARTD 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTD 4530. Media Arts Degree Project. (4 Hours)**

Offers students an opportunity to develop a refined, process-driven media art project that combines personal vision, research, and scholarship. Centers on the creation of a comprehensive capstone project that highlights a specific area of interest and supplements a body of work that has been accumulated through the media arts curriculum. The course structure is based on weekly goals and reviews that are partially determined by the specific and unique aesthetic and technical demands of an individual student's capstone project. A well-planned project statement serves as the method for contextualizing and articulating the unique goals of the capstone project. This advanced studio course provides preparation for graduating students in their careers as professional artists and creative practitioners.

**Attribute(s):** NUpath Capstone Experience

**ARTD 4565. Photography: Visual Strategies + Context. (4 Hours)**

Emphasizes combining students' personal aesthetic choices with refined technical skills in this advanced photography seminar. Students integrate personal vision, historical research, and well-defined concepts in their work. Through lectures on contemporary topics and artist studio and museum visits, students situate their own ideas and processes to historical and cultural forces. Focuses on the relevance of contemporary models in which the still image is used, specifically interdisciplinary approaches.

**Prerequisite(s):** ARTD 3460 with a minimum grade of D-

**ARTD 4570. Animation 2. (4 Hours)**

Continues ARTD 3470. Focuses on seamless integration of animated three-dimensional models with digital photographic backgrounds. Continued emphasis on building comprehensive modeling, surfacing, and animation skills. Students develop original content based on course objectives. Complex systems for creating realistic movement are introduced. Exposes students to compositing and animation processes through lectures, demonstrations, and hands-on assignments.

**Prerequisite(s):** ARTD 3470 with a minimum grade of D-

**ARTD 4575. Animation 3. (4 Hours)**

Continues ARTD 4570. Focuses on building comprehensive modeling, animation, and compositing skills in this advanced studio course. Students explore creating special effects through seamless mixture of computer-generated imagery and digital video footage. Advanced compositing and lighting techniques are introduced and explored. Students create original characters using organic modeling and surfacing techniques. Exposes students to animation and compositing processes through lectures, demonstrations, and hands-on assignments.

**Prerequisite(s):** ARTD 4570 with a minimum grade of D-

**ARTD 4660. Studio Photography. (4 Hours)**

Examines studio practices and lighting techniques. Offers students an opportunity to obtain a thorough understanding and working knowledge of contemporary practice in the photography studio. Includes comprehensive exercises and assignments with various types of lighting equipment.

**Prerequisite(s):** ARTD 2360 with a minimum grade of D-

**ARTD 4661. Photography: Experimental Processes. (4 Hours)**

Offers a studio/lab course in which students study the history of photographic processes and contemporary approaches of the medium while creating their own photographs in the darkroom. Explores 19-century techniques such as camera obscura, photograms, cyanotypes, tintypes, kallitypes, cliché verre, and others. Investigates the use of analog film photography and digital photography in combination with alternative processes. The structure of the course is designed to present exciting ways of thinking about technical questions, materials, subject matter, and aesthetic approaches through experimentation.

**Prerequisite(s):** ARTD 2350 with a minimum grade of D- or ARTD 2360 with a minimum grade of D-

**ARTD 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTD 6490. Advanced Data Art and Hacktivism. (4 Hours)**

Explores the practices and politics of data collection and processing for creative and critical output. Practices how to collect online data with and without APIs and how to process textual data using natural language processing techniques. Engages students in self-directed research using the current social web data collection technologies and application of that research to a creative output. Examines the legal and ethical issues involved in data collection, in addition to the practical, technical, and social problems that can arise during the processing of social data.

**Art - Studio (ARTS)****ARTS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTS 2340. Painting Basics. (4 Hours)**

Presents an introductory studio course in the fundamental techniques of painting. Formal problems in the study of color, light, space systems, form, and composition establish the foundation for more individual creative expression. Uses critiques and slide lectures as needed.

**Attribute(s):** NUpath Creative Express/Innov

**ARTS 2341. Figure Drawing. (4 Hours)**

Focuses on developing the student's awareness of the structure of the figure as well as the emotive qualities of "figuration." Students draw from a model in each class. They also develop drawings based on the political and social concerns of contemporary culture and the role of gender as seen through "image."

**Attribute(s):** NUpath Creative Express/Innov

**ARTS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTS 3000. Topics in Studio Arts. (4 Hours)**

Explores studio arts topics, supporting work in all studio arts disciplines. Examines current discourse in the field and draws on instructor expertise. Students develop original creative projects in response to the topic, informed by critical readings, instructor and guest lectures, examination of other artists' works, and class discussions. Emphasizes skill development and strategies for self-directed studio arts production including experimentation, planning, iteration, revision, and critique of creative work. May be repeated up to five times.

**Prerequisite(s):** ARTF 1120 with a minimum grade of D- or ARTF 1121 with a minimum grade of D- or ARTF 1122 with a minimum grade of D- or ARTF 1200 with a minimum grade of D- or ARTF 1210 with a minimum grade of D- or ARTF 1220 with a minimum grade of D-

**ARTS 3449. Drawing in Mixed Media. (4 Hours)**

Offers an upper-level course designed for students who want to explore the ever-changing discipline of drawing, which has now become a medium that stands on its own. Explores a range of media for generating drawings, including traditional techniques and computer-based media. Emphasizes open-ended application and interpretation of drawing as a medium. Requires students to attend lectures and exhibitions and keep a journal.

**ARTS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ARTS 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**ARTS 5200. Drawing from Object to Concept. (4 Hours)**

Covers the practice of drawing as a fundamental mode of communication and tool for ideation. Teaches drawing through observation of real-world objects and conceptualization of abstract ideas related to personal interests. Develops practical skills to construct two-dimensional images, become familiar with a range of traditional drawing materials, and integrate digital techniques. Focuses on process, perception, critical dialogue, and self-directed research.

**Asian Studies (ASNS)****ASNS 1150. East Asian Studies. (4 Hours)**

Seeks to provide an understanding of the constituent characteristics that originally linked East Asia as a region and the nature of the transformations that have occurred in the region over the last two thousand years. Concentrates on China and Japan, and addresses Korea and Vietnam where possible. Also seeks to provide students with effective interdisciplinary analytical skills as well as historical, ethical, cultural diversity, and aesthetic perspectives. ASNS 1150 and HIST 1150 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ASNS 1246. World War II in the Pacific. (4 Hours)**

Studies World War II, the most devastating war in history, which began in Asia and had a great long-term impact there. Using historical and literary texts, examines the causes, decisive battles, and lingering significance of the conflict on both sides of the Pacific.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**ASNS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ASNS 2245. Introduction to Asian American Studies. (4 Hours)**

Seeks to provide an understanding of the major concepts, historical narratives, and analytical approaches in the field of Asian American studies. Concentrates on the experiences of migrants and descendants from China, Japan, India, Korea, the Philippines, and Southeast Asia. Offers students an opportunity to obtain interdisciplinary analytical skills, including approaches in history, anthropology, sociology, critical ethnic studies, American studies, cultural studies, and media studies.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ASNS 2290. Asian American Politics. (4 Hours)**

Explores the political developments that gave rise to the term "Asian America" in the 1960s and investigates theoretical questions about the complexities and pluralities of the contemporary Asian American experience. Examines Asian American political participation around current issues such as immigration and migration patterns, intragroup coalitions, racial stereotypes, data disaggregation, political representation, voting patterns, policy preferences, and more. Considers the role of American political institutions—including federal, state, and local governments—and how public policies at all levels shape the political lives of Asian Americans in the United States.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**ASNS 2300. The Environment in Asia and the World. (4 Hours)**

Presents an overview of the meanings associated with "the environment" across different cultures. Analyzes how people and institutions have differently conceptualized the relationship between humans and nature (either through philosophy, science, or religion). Demonstrates the connection between present-day environmental crises and cultural/historical factors. Compares different Asian contexts to other geographic areas. Aims to train students to think creatively about alternative human-environment relations.

**Attribute(s):** NUpath Interpreting Culture

**ASNS 2378. Race and Ethnic Politics in the United States. (4 Hours)**

Explores how race and ethnicity influence American political institutions and the behaviors of their residents. Defines concepts like race and ethnicity and the impact that immigration has on diversifying the American polity. Investigates the three dominant ethno-racial minority groups (i.e., Black and African Americans, Asian Americans, and Latinos/as/x) and their political behaviors. Surveys topics such as the formation of partisan identification (i.e., Democrats and Republicans); political representation; policy preferences and public opinions; and mobilization and group-based participation.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**ASNS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ASNS 3100. Asian American Cinemas. (4 Hours)**

Introduces the multiple and complex histories of Asian American cinema, from its genesis as radical independent filmmaking to its development across commercial industries and new digital media. Concentrates on a range of creative productions, from documentary and narrative features to experimental, avant-garde, and short video. Offers students an opportunity to obtain the skills to analyze the institutional processes and historical contexts of Asian American cinema and the genres, techniques, and aesthetics of Asian American filmmakers.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C- or ENGW 1111 with a minimum grade of C- or ENGW 1113 with a minimum grade of C- or ENGW 1114 with a minimum grade of C-

**Attribute(s):** NUpath Difference/Diversity, NUpath Integration Experience, NUpath Interpreting Culture

**ASNS 3482. East Asian Politics. (4 Hours)**

Examines the politics of East Asian societies as they cope with a variety of challenges. Focuses on economic development, environment, energy, and security in Japan, China, and the Koreas.

**Prerequisite(s):** ASNS 1150 with a minimum grade of C or POLS 1155 with a minimum grade of C

**ASNS 3485. China: Governance and Foreign Policy. (4 Hours)**

Focuses on China's political system and the major issues confronted: leadership recruitment and succession, economic policies and development, class and class struggle, political culture and socialization, human rights, civil society, the media, and both internal and external security concerns. Examines how ideology, development, culture, and the pursuit of China's national interest affect governance.

**Prerequisite(s):** POLS 1155 with a minimum grade of D-

**ASNS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ASNS 4220. South Asian Diasporas. (4 Hours)**

Seeks to provide an understanding of South Asians as one of the largest migrant communities globally, coming from India, Pakistan, Bangladesh, Nepal, Myanmar, Bhutan, and Sri Lanka. Concentrates on the diaspora as a heterogeneous group comprising multiple nationalities, religions, castes, classes, languages, and genders. Examines the history, opportunities, and challenges of South Asian mobility and migration. Draws from texts in sociocultural anthropology, Asian American studies, history, and transnational feminist studies to trace the emergence of a new global regime on migration and citizenship through the unprecedented mobility of South Asians in the 20th and 21st centuries.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**ASNS 4900. Asian Studies Capstone Directed Study. (4 Hours)**

Offers independent intensive reading and writing on key interdisciplinary issues in Asian studies under the direction of faculty members in Asian studies on a topic chosen in consultation with the instructor.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**ASNS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ASNS 4992. Directed Study. (1-4 Hours)**

Offers students an opportunity for special readings and research in Asian studies. May be repeated without limit.

## Arts Administration and Cultural Entrepreneurship (AACE)

**AACE 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AACE 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AACE 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AACE 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**AACE 6000. Arts and Culture Organizational Leadership. (3 Hours)**

Offers an overview and introduction to leadership knowledge areas, tools, and skills sets for the arts and culture sector. Key topics include issues and challenges in the management of arts-oriented organizations, leadership characteristics and techniques for arts and culture teams, balancing organizational priorities with artistic vision and values, board formation and management, audience outreach, and operational practices. Focuses on the administration of people and processes to communicate mission; realize goals; and effectively manage the creative resources, human resources, and financial challenges of nonprofit arts and cultural organizations.

**AACE 6010. Planning for Arts and Cultural Organizations. (3 Hours)**

Offers an overview and introduction to knowledge areas and primary skills sets for planning, launching, and sustaining arts and cultural organizations. Key topics include evaluating opportunities in the arts and culture sector; building effective vision, mission, and values for arts and culture initiatives in balance with civic and community contexts; smart approaches to arts and culture funding; developing sustainable and flexible strategic plans; and planning challenges for the contemporary strategic arts organization.

**AACE 6020. Experiential Study in Arts Administration. (3 Hours)**

Offers students an opportunity to learn best practices in arts project management, including how to assess and scope a project, develop a timeline with clear action items and goals, relay needs and expectations to clients, research materials to assist in the process, and measure and deliver project results. Faculty coach students to cultivate professional skill sets, build competency around key areas of student interest, and bridge theory with practice. Students receive feedback from their project sponsor, review lessons learned, and incorporate suggestions to improve and further develop their career plans. Seeks to support the development of business communication skills, project and client management skills, and frameworks for analysis.

**AACE 6110. Information Technology for Arts and Cultural Organizations. (3 Hours)**

Offers nontechnical students an opportunity to obtain a clear and current understanding of key information technology (IT) concepts set in the context of arts and cultural organizations and to empower them to make decisions that map technology to strategy. Covers how to identify technical terms, stakeholders, and issues; evaluate IT challenges; apply best-practice frameworks; and identify business needs and compare technical solutions in order to minimize cost and maximize strategic alignment. Combines readings, casework, video lectures, screen casts, guest videos, and a hands-on approach to researching solutions and leading change. Includes both group and individual deliverables that students synthesize to create and present a final project.

**AACE 6120. Advocacy and the Arts. (3 Hours)**

Seeks to equip future arts leaders with the competence, power, and commitment to act in the interest of creative resilience—and creativity—for the collective good. Offers students an opportunity to learn how to both advocate for the arts and advocate through the arts. Each module presents a specific challenge faced by artists and arts institutions and compels students to identify and articulate creative solutions to overcome this challenge. Exposes students to diverse knowledge sources—including theoretical and practical literature, organizational and project case studies, and guest presentations by arts leaders in the Boston area—to help prepare students for this important work.

**AACE 6200. Programming and Community Engagement for Cultural Entrepreneurs. (3 Hours)**

Examines the role and tools of the cultural entrepreneur and investigates practical and tactical approaches centered around real-world examples. Topics include how cultural entrepreneurs turn new ideas into concrete initiatives and how they communicate with and learn from their audiences and communities to assess and evaluate the implementation of cultural endeavors. Offers students an opportunity to create their own cultural initiative from the ground up. Through modules covering mission and vision, program evaluation, community engagement, and basic resource management, the successful student should finish the course with a real project “in a box,” ready to launch.

**AACE 6210. Building Value Through Cultural Enterprise. (3 Hours)**

Examines the question of value through the lens of cultural institutions big and small. Explores examples from real-world case studies. Focuses on areas of value, ways to measure impact on both qualitative and quantitative levels, and how to demonstrate that impact to a variety of audiences from our daily visitors to our federal government. Value in the cultural sector is a critical question that institutions and individuals working in this area must answer on a regular basis for themselves, their constituents, and their supporters.

**AACE 6220. Innovative Approaches to Audience Engagement. (3 Hours)**

Investigates the philosophy, methods, and application of a wide spectrum of audience engagement strategies. Utilizes provided materials, inquiry-based research practices, and experiential study to introduce students to the various interpretations and outcomes of effective audience engagement, particularly as it relates to an arts organization’s mission, vision, and values. Drawing directly from their course work and research, students are paired with an arts organization to design a creative audience engagement strategy that both aligns with the organization’s mission and supports a new visionary initiative.

**AACE 6300. Fundraising in the Arts. (3 Hours)**

Offers advanced study of fundraising and resource development within the arts and cultural sector. Designed to help students develop the knowledge and skills required to create and increase various revenue streams. Covers fundraising ethics, grant writing, sponsorship proposals, pitching, stakeholder and volunteer engagement, storytelling, and other skills necessary to support fundraising goals. When applicable, students are encouraged to use this course to explore and apply fundraising fundamentals for their organization, startup, or creative practice.

**AACE 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Behavioral Neuroscience (BNSC)

**BNSC 1000. Behavioral Neuroscience at Northeastern. (1 Hour)**

Introduces first-year and new transfer students to the major and the field of behavioral neuroscience and to the professional and academic resources available to students at Northeastern University. Acquaints students with their faculty, advisors, and fellow students; provides an initial orientation to undergraduate research, cooperative education, study abroad, and other experiential learning options; familiarizes students with academic support resources and leadership opportunities; provides grounding in the culture and values of the university community —in short, familiarizes students with all skills needed to become a successful university student.

**BNSC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BNSC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BNSC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BNSC 4900. Behavioral Neuroscience Capstone. (1 Hour)**

Designed as an integrative capstone experience for behavioral neuroscience students who are also enrolled in approved research courses where they conduct original research under the direction of an approved mentor. Students gain experience in writing a research proposal, conducting the proposed research, producing a research report, and presenting their work. Students engage in solving novel problems while reflecting on and integrating their prior learning in the discipline. Requires writing with revision and oral presentation. Offers students an opportunity to refine reflection and communication skills through formal and informal presentations, discussions, and critique.

**Prerequisite(s):** BIOL 4991 (may be taken concurrently) with a minimum grade of D- or BNSC 4991 (may be taken concurrently) with a minimum grade of D- or BNSC 4994 (may be taken concurrently) with a minimum grade of D- or PSYC 4991 (may be taken concurrently) with a minimum grade of D- ; (ENGW 3307 with a minimum grade of C or ENGW 3315 with a minimum grade of C or ENGW 3302 with a minimum grade of C )

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**BNSC 4950. Seminar. (1-4 Hours)**

Offers an in-depth study of selected topics.

**BNSC 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**BNSC 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. Requires a 3.500 GPA. May be repeated without limit.

**Prerequisite(s):** BNSC 4970 with a minimum grade of D- or BNSC 4991 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Integration Experience, NUpath Writing Intensive

**BNSC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BNSC 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**BNSC 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

## Biochemistry (BIOC)

**BIOC 1000. Biochemistry at Northeastern. (1 Hour)**

Introduces first-year students to the major and the field of biochemistry and to the professional and academic resources available to students at Northeastern University. Acquaints students with their faculty, advisors, and fellow students; provides an initial orientation to undergraduate research, cooperative education, and other experiential learning options; helps develop the academic skills necessary to succeed; provides grounding in the culture and values of the university community; and assists in interpersonal skill development—in short, familiarizes students with the resources and skills needed to become a successful university student.

**BIOC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOC 4900. Biochemistry Capstone. (1 Hour)**

Designed for students who are also enrolled in approved 4-semester-hour research courses in which they each conduct original experimental work under the direction of an approved mentor. Requires reflection by students on their various educational experiences, extensive research of scientific questions related to these experiences (with the research itself carried out in the approved research course), and development of an original research report. Required components include writing with revision and a major oral presentation. Offers students an opportunity to hone reflection and communication skills through formal and informal presentations, class discussion, and critique. Requires concurrent registration in BIOC 4991, BIOC 4994, BIOL 4991, CHEM 4991, or other 4-SH research course approved by the Biochemistry Director.

**Prerequisite(s):** (BIOC 4991 (may be taken concurrently) with a minimum grade of D- or BIOC 4994 (may be taken concurrently) with a minimum grade of D- or BIOL 4991 (may be taken concurrently) with a minimum grade of D- or CHEM 4991 (may be taken concurrently) with a minimum grade of D-); BIOL 3611 with a minimum grade of D- ; (ENGW 3302 with a minimum grade of C or ENGW 3307 with a minimum grade of C or ENGW 3315 with a minimum grade of C )

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**BIOC 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on an in-depth project in which a student conducts research or produces a product related to the student's major field. Requires dean's office approval. Can be combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project.

**BIOC 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. Requires Dean's office approval.

**Prerequisite(s):** (BIOC 4970 with a minimum grade of D- or BIOC 4991 with a minimum grade of D- or BIOL 4970 with a minimum grade of D- or BIOL 4991 with a minimum grade of D- or CHEM 4750 with a minimum grade of D- or CHEM 4901 with a minimum grade of D- or CHEM 4970 with a minimum grade of D- ); BIOL 3611 with a minimum grade of D- ; (ENGW 3302 with a minimum grade of C or ENGW 3307 with a minimum grade of C or ENGW 3315 with a minimum grade of C )

**Attribute(s):** NUpath Capstone Experience, NUpath Integration Experience, NUpath Writing Intensive

**BIOC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOC 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit. Cannot be a paid experience.

**Attribute(s):** NUpath Integration Experience

**BIOC 4994. Internship. (4 Hours)**

Offers an opportunity for students who have completed a co-op to undertake an unpaid internship. May be repeated twice for credit.

**Attribute(s):** NUpath Integration Experience

**BIOC 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Bioengineering (BIOE)****BIOE 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOE 2350. Biomechanics. (4 Hours)**

Designed to acquaint students with concepts of stress, strain, and constitutive laws as applied to problems in biomechanics. Introduces rigid body and deformable body mechanics. Focuses on basic foundations of solid mechanics using vectors and tensors. Illustrative examples from tissue and cell biomechanics are given where appropriate.

**Prerequisite(s):** (MATH 1252 with a minimum grade of D- or MATH 1342 with a minimum grade of D- ); (PHYS 1151 with a minimum grade of D- or PHYS 1161 with a minimum grade of D- or PHYS 1171 with a minimum grade of D- )

**BIOE 2355. Quantitative Physiology for Bioengineers. (4 Hours)**

Introduces engineering and science students to core knowledge and understanding of physiological systems and processes. Focuses on quantitative analysis of human physiological systems. Topics include the physical and chemical foundations of physiology; coupled forces and flows; electrical, mechanical, and chemical potentials and their conjugated fluxes; and the physiology of excitable tissue. Examines cell structure, function, and homeostasis with a particular focus on membrane transport, osmotic pressure, cell signaling, and cellular energetics.

**Prerequisite(s):** MATH 2341 (may be taken concurrently) with a minimum grade of D- ; (CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1211 with a minimum grade of D- or CHEM 1217 with a minimum grade of D- ); (PHYS 1155 (may be taken concurrently) with a minimum grade of D- or PHYS 1165 (may be taken concurrently) with a minimum grade of D- or PHYS 1175 (may be taken concurrently) with a minimum grade of D- )

**BIOE 2365. Bioengineering Measurement, Experimentation, and Statistics. (4 Hours)**

Introduces the fundamentals of biomedical data acquisition and statistical analysis. Engineering statistics topics include descriptive statistics, probability distributions, hypothesis testing, analysis of variance, and experiment design. Applies these statistical topics by analyzing data obtained from laboratory exercises in BIOE 2366. Laboratory exercise topics include cell culture, mechanical testing, modeling medical imaging data, 3D printing, and bioprinting. Emphasizes using MATLAB software to analyze data on the computer.

**Prerequisite(s):** (BIOL 1107 (may be taken concurrently) with a minimum grade of D- or BIOL 1111 (may be taken concurrently) with a minimum grade of D- or BIOL 1115 (may be taken concurrently) with a minimum grade of D- ); (MATH 1242 (may be taken concurrently) with a minimum grade of D- or MATH 1252 (may be taken concurrently) with a minimum grade of D- or MATH 1342 (may be taken concurrently) with a minimum grade of D- ); (ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Corequisite(s):** BIOE 2366

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Writing Intensive

**BIOE 2366. Lab for BIOE 2365. (1 Hour)**

Offers associated laboratory exercises for BIOE 2365. Requires lab reports from all students.

**Corequisite(s):** BIOE 2365

**BIOE 2949. Introductory Directed Research in Bioengineering. (4 Hours)**

Offers an opportunity to pursue project and other independent inquiry opportunities under faculty supervision for first- and second-year students. The course is initiated with a student-developed proposal, including expected learning outcomes and research products, which is approved by a faculty member in the department. Permission of instructor required.

**BIOE 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOE 2992. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors. May be repeated up to nine times.

**BIOE 3210. Bioelectricity. (4 Hours)**

Discusses principles of electrical circuit theory and analysis methods for understanding and designing biomedical devices and biological sensors. Covers basic circuit components, network analysis methods, RC and RL circuits, AC circuit analysis, equivalent circuits, biopotential amplifiers, and biopotential electrodes. Introduces biosensing, biosignal processing, and operating principles of electrically active cells and tissues.

**Prerequisite(s):** (MATH 2321 with a minimum grade of D- ; MATH 2341 with a minimum grade of D- ); (PHYS 1155 with a minimum grade of D- or PHYS 1165 with a minimum grade of D- or PHYS 1175 with a minimum grade of D- )

**BIOE 3310. Transport and Fluids for Bioengineers. (4 Hours)**

Covers the fundamental principles of processes and systems in which mass, energy, and momentum are transported in typical biological problems. Emphasizes momentum transport for incompressible and compressible fluids (fluid flow) and energy transport. The methods taught are relevant to the analysis of physiological systems, processing, and separation of biological materials.

**Prerequisite(s):** BIOE 2350 with a minimum grade of D- ; BIOE 2355 with a minimum grade of D- ; (MATH 2321 with a minimum grade of D- ; MATH 2341 with a minimum grade of D- )

**BIOE 3380. Biomolecular Dynamics and Control. (4 Hours)**

Focuses on the principles of thermodynamics and kinetics applied to the analysis and design of biomolecular systems. Covers foundational topics—such as mass and energy balances, chemical equilibria, and enzyme kinetics—in a biological context. Introduces the role of feedback and feed-forward control in biomolecular networks, emphasizing basic analytical and computational methods, including the use of MATLAB, for analyzing how these regulatory structures affect the dynamics of small-scale, prototypical networks.

**Prerequisite(s):** (MATH 2321 with a minimum grade of D- ; MATH 2341 with a minimum grade of D- ); BIOE 2355 with a minimum grade of D-

**BIOE 3410. Experimental Laboratory Methods. (4 Hours)**

Offers advanced bioengineering laboratory exercises with emphasis on techniques central to molecular, cellular, and tissue engineering. Laboratory exercise topics include PCR and qPCR, protein chemistry, bioconjugation, enzyme kinetics and enzyme-substrate interactions, polymers, surface modification, 3D bioprinting, fluorescence microscopy, and image analysis. Students build on previous courses by applying experimental design concepts, including sample size selection for statistical power, repeats vs. replicates, experimental treatments and groupings for ANOVA and mixed model analysis, and designing a robust standard curve, to research questions. Students apply MATLAB, microscopy imaging software, and molecular visualization and docking software to analyze experimental data. Requires in-class participation and written lab assignments and reports from all students.

**Prerequisite(s):** BIOE 2365 with a minimum grade of D- ; BIOE 2366 with a minimum grade of D-

**BIOE 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOE 4790. Capstone Design 1. (4 Hours)**

Offers the first in a two-course sequence of capstone design. Introduces principles of engineering design and applies them to the design of bioengineered devices. Topics consist of ethics, cost engineering, research methods, intellectual property, technical report writing, and FDA design control—including inputs, outputs, verification, validation, and design history files. Students are formed into teams and paired with a faculty advisor and supporter. Project support can be departmental, industrial, or external. Students defend a preliminary design project proposal in written and oral form before a faculty jury.

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov, NUpath Writing Intensive

**BIOE 4792. Capstone Design 2. (4 Hours)**

Continues BIOE 4790. Offers students an opportunity to apply design principles to create a device or process to solve a relevant bioengineering problem. Teams develop, construct, and evaluate prototypes under real-world fiscal, regulatory, and safety conditions. Progress is monitored through a series of oral presentations in design gate review meetings. The design process is documented in a design history file that is reviewed throughout the course. Requires students to complete a working prototype or simulation, as appropriate, and a final written report.

**Prerequisite(s):** BIOE 4790 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov, NUpath Writing Intensive

**BIOE 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**BIOE 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** BIOE 4970 with a minimum grade of D-

**BIOE 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOE 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**BIOE 4992. Directed Study. (1-4 Hours)**

Offers theoretical or experimental work under the direction of members of the department under a chosen topic. Course content depends on instructor. May be repeated without limit.

**BIOE 5060. Special Topics in Bioengineering. (4 Hours)**

Focuses on topics of timely interest to students of science and engineering. Topic varies from semester to semester. When appropriate, the course takes advantage of unique opportunities afforded by visiting faculty and guests. May be repeated once.

**BIOE 5115. Dynamical Systems in Biological Engineering. (4 Hours)**

Introduces the theoretical analysis and modeling of dynamical systems in biology, ranging from molecular to population applications. Topics include difference and differential equation models, with basic theory including nondimensionalization, steady states, linearization, stability, eigenvalues, global behavior, singular perturbations, multistability, hysteresis, cooperativity, periodic solutions, excitable systems, bifurcations; and an introduction to spatial (PDE) models. Develops all concepts in the context of concrete biological applications, such as gene regulation; chemical reaction networks and stoichiometry; drug models and PK/PD; receptor/ligand interactions; synthetic constructs; action potential generation; enzymatic reactions; population interactions; epidemiology; epigenetic phenomena, including differentiation and transport; chemotaxis; and diffusion.

**Prerequisite(s):** MATH 2341 with a minimum grade of D- or graduate program admission

**BIOE 5150. Foundational Mathematics of Bioengineering. (4 Hours)**

Covers two key mathematical topics: linear algebra and differential equations. Explores linear functions, matrices, and vector spaces in the first half, followed by linear ordinary differential equations and analytical and numerical solution methods in the second half. Emphasizes practical applications of these concepts in various contexts.

**BIOE 5151. Computational Tools in Bioengineering. (4 Hours)**

Introduces programming and essential numerical methods with applications in bioengineering. Covers scripting, plotting, matrix operations, root-finding techniques, numerical integration, and solving ordinary differential equations. Focuses on developing practical problem-solving skills.

**Prerequisite(s):** BIOE 2365 with a minimum grade of D- or graduate program admission

**BIOE 5235. Biomedical Imaging. (4 Hours)**

Presents the foundations of modern medical imaging, including imaging principles, imaging mathematics, imaging physics, and image-generation techniques. Includes X-ray, ultrasound, computed tomography, and magnetic resonance imaging.

**Prerequisite(s):** BIOE 5800 (may be taken concurrently) with a minimum grade of D- or BIOE 5800 (may be taken concurrently) with a minimum grade of C- (Graduate) or EECE 2520 (may be taken concurrently) with a minimum grade of D-

**BIOE 5250. Regulatory and Quality Aspects of Medical Device Design. (4 Hours)**

Covers engineering design challenges intrinsic to the development of biomedical devices, including clinical evaluation, manufacture, and testing of medical devices and the constraints that FDA regulations place on these processes. Topics include quality systems, design control, cybersecurity concerns, the role of standards in global device regulation, and the design process. Students are asked to form teams and to carry out a semester-long conceptual design project to develop a design overview, design plan, design input specifications, and verification test procedures for a novel medical device.

**BIOE 5410. Molecular Bioengineering. (4 Hours)**

Introduces the fundamentals of molecular structure and function that underpin engineering of biological macromolecules. Builds on this base with the application of design concepts for molecules and methods of structural and functional analyses and strategies for design and redesign of therapeutic molecules. Projects seek to provide students with experience in conceptual design to create strategies to address significant health concerns.

**Prerequisite(s):** ((BIOL 1111 with a minimum grade of D- or BIOL 1115 with a minimum grade of D-); MATH 1342 with a minimum grade of D- ) or graduate program admission

**BIOE 5411. Applied Molecular Bioengineering. (4 Hours)**

Examines the fundamentals of molecular structure and function within cellular systems, and studies how to build tools based on those fundamental principles for manipulating or analyzing biological systems. Covers a range of topics including chemical structure of biological macromolecules; central dogma; tools to synthesize, perturb, and analyze biological macromolecules; as well as more applied topics including gene therapies and vaccine development. Emphasizes design principles of molecular bioengineering, developing familiarity with publicly available molecular biology software and databases, as well as science communication.

**BIOE 5420. Cellular Engineering. (4 Hours)**

Analyzes the techniques that form the foundation of molecular cell engineering, including recombinant DNA, cloning and genomics, prokaryotic and eukaryotic gene regulation and single-cell gene expression, structure, dynamics of gene regulatory networks, metabolism and cellular energetics, cell structure, cytoskeleton and cellular motors, synthetic gene circuits, and metabolic engineering.

**Prerequisite(s):** BIOE 2355 (may be taken concurrently) with a minimum grade of D- or graduate program admission

**BIOE 5430. Principles and Applications of Tissue Engineering. (4 Hours)**

Applies the principles of biology and biomedical engineering to the creation of artificial organs for transplantation, basic research, or drug development. Requires integration of knowledge of organic chemistry, cell biology, genetics, mechanics, biomaterials, nanotechnology, and transport processes to create functional organs. Reviews basic cell culture techniques, structure function relationships, cellular communication, natural and artificial biomaterials, and the basic equations governing cell survival and tissue organization.

**Prerequisite(s):** BIOE 2355 (may be taken concurrently) with a minimum grade of D- or graduate program admission

**BIOE 5440. The Cell as a Machine. (4 Hours)**

Introduces the key roles that physical forces, the extracellular matrix, and cytoskeletal structure play in the development of human diseases. Views the cell as an engineering system that is capable of sensing physical cues from its environment, integrating such information from different mechanosensors, and responding to changes in its external environment in a coherent manner. Uses mathematical and computational models to explain how cells sense and respond to physical cues.

**Prerequisite(s):** (BIOE 3380 with a minimum grade of D- ; (BIOE 2350 with a minimum grade of D- or ME 2355 with a minimum grade of D- )) or graduate program admission

**BIOE 5450. Stem Cell Engineering. (4 Hours)**

Covers engineering principles and approaches in stem cell research and their application in tissue engineering and regenerative medicine. Emphasizes recent technology and engineering tools used to understand and manipulate stem cells. Topics covered include embryonic and adult stem cell biology fundamentals; quantitative modeling of stem cell signaling; genetic/biochemical/biophysical/biomechanical/biomaterials tools to control stem cell fate and differentiation; epigenetic editing and cellular reprogramming; engineering biomimetic and bioreactor environments to develop stem-cell-based therapies; and various applications in tissue development, diseases, and regeneration.

**Prerequisite(s):** (BIOE 5420 with a minimum grade of C- or BIOE 5420 with a minimum grade of D- ); (BIOE 5430 with a minimum grade of C- or BIOE 5430 with a minimum grade of D- )

**BIOE 5510. Bioengineering Products/Technology Commercialization. (4 Hours)**

Focuses on the translation and commercialization of bioengineering products and technology. Offers students an opportunity to gain essential entrepreneurship skills through studying and exercising the key elements and processes in establishing and launching a biotechnology startup. Examines how to assess bioengineering product and technology opportunities, evaluate the technology's market potential, navigate the landscape of intellectual property protection and FDA regulation for bioengineering products, form a biotechnology startup company, write a business plan, and pitch startups to prospective investors. Covers fundamentals of engineering economics.

**BIOE 5520. Bioengineering Design for Robotic Rehabilitation. (4 Hours)**

Covers the intersection of robotics, physical therapy, rehabilitation, and movement sciences. Students engage in hands-on projects derived from real-world challenges in collaboration with clinical experts. Follows a systematic design process, from conceptualization to prototype development, emphasizing the application of robotics to enhance therapeutic and rehabilitative outcomes. Key topics include biomechanics, motor control and learning, and sensor integration. Emphasizes collaborative teamwork with peers, faculty, and clinical professionals. Concludes with a project presentation demonstrating functional prototypes to address specific needs in rehabilitation.

**Prerequisite(s):** (BIOE 3210 with a minimum grade of D- ; BIOE 2350 with a minimum grade of D- ) or graduate program admission

**BIOE 5630. Physiological Fluid Mechanics. (4 Hours)**

Analyzes biofluids and their mechanics, including cardiovascular fluid mechanics. Examples are taken from biotechnology processes and physiologic applications, including the cardiovascular, respiratory, ocular, renal, musculoskeletal, and gastrointestinal systems. Topics include dimensional analysis, particle kinematics in Eulerian and Lagrangian reference frames, constitutive equations and Newtonian/non-Newtonian biofluid models, flow and wave propagation in flexible tubes, and oscillatory and pulsatile flows.

**Prerequisite(s):** (BIOE 3310 with a minimum grade of D- or ME 3475 with a minimum grade of D- or ME 3480 with a minimum grade of D- ) or graduate program admission

**BIOE 5640. Computational Biomechanics. (4 Hours)**

Identifies and reviews the fundamental conservation principles that govern structural mechanics and fluid dynamics in biological systems. Discusses the following numerical analysis techniques: parameter estimation, finite difference, numerical integration, and finite element methods. By combining conservation laws with numerical analyses techniques, develops approaches to describe the physiological function of various biological systems, allowing for a system of equations to be used to describe a biological problem and solve this system numerically to predict its behavior.

**BIOE 5648. Biomedical Optics. (4 Hours)**

Covers biomedical optics and discusses the theory and practice of biological and medical applications of lasers. Topics covered include fundamentals of light propagation in biological tissues; light-matter interactions such as elastic and inelastic scattering; fluorescence and phosphorescence; diagnostic imaging techniques such as confocal fluorescence microscopy, diffuse optical tomography, and optical coherence tomography; and therapeutic interventional techniques, including photodynamic therapy, laser thermal therapies, and fluorescence-guided surgeries. EECE 5648 and BIOE 5648 are cross-listed.

**Prerequisite(s):** BIOE 5800 (may be taken concurrently) with a minimum grade of D- or BIOE 5800 (may be taken concurrently) with a minimum grade of C- (Graduate) or EECE 2520 (may be taken concurrently) with a minimum grade of D-

**BIOE 5650. Multiscale Biomechanics. (4 Hours)**

Seeks to help students develop and apply scaling laws and continuum mechanics to biomechanical phenomena at different length scales starting from a single molecule, moving up to the cellular and tissue levels. Topics include structure of tissues and the molecular basis for macroscopic properties; chemical and electrical effects on mechanical behavior; cell mechanics, motility, and adhesion; biomembranes; biomolecular mechanics and molecular motors; and experimental methods for probing structures at the tissue, cellular, and molecular levels.

**Prerequisite(s):** (BIOE 2355 with a minimum grade of D- ; MATH 2341 with a minimum grade of D- ) or graduate program admission

**BIOE 5660. Integrative Mechanobiology. (4 Hours)**

Introduces integrative approaches to mechanobiology, from molecular and cell behavior to multicellular, tissue, and organ environments. Covers mechanical basis of life, cytoskeletal forces and structure, rheological properties of cells, mechanobiology technologies and models, mechanics of cancer, embryogenic development and stem cells, and aging. Discusses critical issues facing mechanobiology for solving medical and health problems.

**Prerequisite(s):** (BIOE 2350 with a minimum grade of D- or ME 2355 with a minimum grade of D- ) or graduate program admission

**BIOE 5710. Experimental Systems and Synthetic Bioengineering. (4 Hours)**

Introduces experimental aspects of systems and synthetic bioengineering. Offers students an opportunity to learn how to plan and execute quantitative experiments, how to apply engineering principles to design laboratory research and to interpret data, and how to design and implement synthetic genetic or enzymatic circuits. Through team projects, explores techniques in nucleic acid, protein, and genetic engineering; quantitative measurements at the single-cell level and beyond; design and applications of synthetic circuits; and discusses ethical considerations.

**Prerequisite(s):** BIOE 2355 with a minimum grade of D- or graduate program admission

**BIOE 5711. Advanced Experimental Systems and Synthetic Bioengineering. (4 Hours)**

Examines advanced experimental techniques in modern systems and synthetic bioengineering for designing, building, testing, and refining biological systems. Applies engineering principles to construct biological systems inspired by bacteria, plants, and animals. Introduces foundational methods including genetic library creation and screening, protein expression and purification, spectroscopy, flow cytometry, fluorescence microscopy, and behavioral studies of learning and memory. Focuses on the application and analysis of these techniques in developing biological systems from the ground up.

**Prerequisite(s):** BIOE 5710 with a minimum grade of D- or BIOE 5710 with a minimum grade of C- (Graduate)

**BIOE 5720. Physical Bioengineering. (4 Hours)**

Covers biopolymer conformations, cell membrane mechanics, chemical reaction kinetics and applications to polymerization and molecular motors, electric fields, and action potential propagation. Recent years have seen a tremendous growth in the use of ideas and methods from physical science and engineering to obtain a better understanding of biological phenomena and for applications of that understanding to societal needs, ranging from health to agriculture. Underlying these efforts are principles from statistical physics that establish the framework for this increasingly popular part of bioengineering.

**Prerequisite(s):** BIOE 2365 with a minimum grade of D- or BIOE 3380 with a minimum grade of D- or graduate program admission

**BIOE 5740. Intermediate Computing Skills for Bioengineers. (4 Hours)**

Offers students an opportunity to boost their overall capability using computing systems, training them with a comprehensive set of skills ranging from simple scripting to writing modular, portable, and maintainable code bases with up-to-date software engineering best practices such as version control, unit testing, continuous integration/continuous delivery, and license auditing.

**BIOE 5750. Modeling and Inference in Bioengineering. (4 Hours)**

Develops a set of statistical tools to address poorly posed inverse problems. Interpreting complex and partial information is a routine task in research as well as in our daily lives. Such tasks include estimating quantitative properties of a biological system from indirect noisy measurements, responding to fluctuating environmental signals, or breaking encrypted messages. Common to these diverse questions is a need to construct a predictive model from partial data. Draws on examples from primary literature in biology to study text recognition, trait mapping, sequence alignment, decoding cryptographs, processing of chemoattractive signals to find food, and survival strategies of bacteria in unpredictable environments.

**Prerequisite(s):** ((MATH 2321 with a minimum grade of D- ; MATH 2341 with a minimum grade of D- ); (BIOE 2365 with a minimum grade of D- or (CHME 3315 with a minimum grade of D- ; CHME 4315 with a minimum grade of D- ))) or graduate program admission

**BIOE 5760. Method and Logic in Systems Biology and Bioengineering. (4 Hours)**

Emphasizes difficulties that lie at the interface of theory and experiment in bioengineering and systems biology. Covers stem cell engineering, directed differentiation, engineering biological circuits, cooperativity, robust adaptation, kinetic proofreading, signal transduction and information processing in biological systems, network analysis, dynamical systems, and biological design principles. This course is based on reading and discussing primary literature that exemplifies approaches that have revealed new concepts and principles governing biological systems. Each week, students read and discuss two important papers. The instructor provides relevant background and frames the examined papers in the context of the field and their time period as the basis for class discussion.

**BIOE 5770. Machine Learning Methods in Biology and Health. (4 Hours)**

Addresses pressing challenges at the intersection of biology, health, and technology. Explores cutting-edge AI techniques revolutionizing biological and biomedical research, biotechnology, and healthcare. Introduces machine and deep learning concepts, emphasizing applications such as medical image analysis, anomaly detection in biological signals, medical record processing, and integrating genomic and multimodal data for insights. Highlights advancements in diagnostics, drug discovery, personalized medicine, protein folding, synthetic biology, and automated modeling. Designed for those with a background in computer programming and probability theory.

**Prerequisite(s):** BIOE 2365 with a minimum grade of D- or graduate program admission

**BIOE 5800. Systems, Signals, and Controls for Bioengineers. (4 Hours)**

Explores the concepts of systems and transfer functions. Enables the breakdown of complex systems to simpler ones and the integration of simpler modules to form complex functions. Covers analytical tools, applies frequency-domain analyses (e.g., Fourier, Laplace, and Z-transforms) to simplify continuous and discrete-time systems, and assesses their stability and frequency responses. Examines the characterization and combination of analog and digital signals produced by electronic and biological circuits, as well as design controllers, to achieve desired biosystem behavior. Focuses on the design of filters and controllers in both analog and digital forms to measure and manipulate complex real-world bioengineering systems, including image processing for 2D signals.

**Prerequisite(s):** MATH 2341 with a minimum grade of D- or graduate program admission

**BIOE 5810. Design of Biomedical Instrumentation. (4 Hours)**

Investigates the principles of biology and engineering underlying the design and use of biomedical instrumentation. Topics include design of a broad range of instrumentation and monitoring devices, sensors, and integrated systems. Graduate students interested in taking this course should have completed an equivalent introductory circuits course.

**Prerequisite(s):** (BIOE 3210 with a minimum grade of D- ; BIOE 5800 (may be taken concurrently) with a minimum grade of D- ) or BIOE 5800 (may be taken concurrently) with a minimum grade of C- (Graduate)

**BIOE 5820. Biomaterials. (4 Hours)**

Offers a broad overview of the field of biomaterials (materials used in medical devices that interact with living tissues). Introductory lectures cover biomaterials and their translation from the laboratory to the medical marketplace. Discusses important biomaterials terminology and concepts. Emphasizes material structure-property-function-testing relationships and discusses specific materials used in medical devices and drug delivery. Concludes with introductions to topics in the field, such as biomaterials-tissue interactions, tissue engineering, and regulatory requirements. Considers principles of device design as related to the selection and application of biomaterials.

**Prerequisite(s):** (CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1211 with a minimum grade of D- or CHEM 1217 with a minimum grade of D- ) or graduate program admission

**BIOE 5850. Design of Implants. (4 Hours)**

Uses an interdisciplinary approach to evaluate how a team designs medical implants to meet unmet clinical needs. Covers biomaterials, interfacial phenomena/surface science, phenomena/surface science, the lymphatic system, immune response, aging, mechanical factors, sterilization methods, and human factors. Presents exogenous factors, including intellectual property, regulatory requirements, affordability, product liability, and bioethics. The class is divided into teams that design proprietary medical devices using a unit processes/case study approach presented by experts with firsthand experience in meeting unmet market needs.

**Prerequisite(s):** BIOE 5820 (may be taken concurrently) with a minimum grade of D- or BIOE 5820 (may be taken concurrently) with a minimum grade of C- (Graduate)

**BIOE 5860. Engineering Approaches to Precision Medicine I. (4 Hours)**

Covers the field of biomedical data science. Teams of students undertake projects solicited from biomedical PIs in broad areas of biomedical research, using datasets and developing a project work plan. Studies how to estimate a patient's state of health using their health data and to use modeling and machine learning methods to project that health state to make personalized predictions. Includes lectures on physiology, medicine, and engineering principles (probability, machine learning) relevant to each project; faculty mentors assist student projects with challenges. Requires project updates to the class at regular intervals so that teams gain experience with presenting.

**Prerequisite(s):** MATH 2341 with a minimum grade of D- or MATH 2331 with a minimum grade of D- or graduate program admission

**BIOE 5870. Engineering Approaches to Precision Medicine II. (4 Hours)**

Applies core knowledge of biomedical data science methods developed in BIOE 5860 to students' research projects under the mentorship of biomedical and engineering PIs. Research projects originate from clinical research and are designed to train students in understanding how to mathematically and computationally define and estimate a patient's state of health and how to use modeling and machine learning methods to make personalized predictions. Successfully making predictions in advance allows physicians to intervene early to help the patient.

**Prerequisite(s):** BIOE 5860 with a minimum grade of C-

**BIOE 5880. Computational Methods in Systems Bioengineering. (4 Hours)**

Introduces students to the use of computational methods in studies of systems biology, computational bioengineering, and data science and their extended utilities in a wide variety of applications in science and engineering. Covers basic elements of numerical methods and algorithms for solving different types of differential equations, running simulations, and performing optimization and data analysis. Emphasizes the concept and principle of each algorithm and its usage in R programming in the context of real-world applications in systems biology, bioinformatics, computational biology, and data science.

**Prerequisite(s):** BIOE 3380 with a minimum grade of D- or graduate program admission

**BIOE 6000. Principles of Bioengineering. (1 Hour)**

Covers the fundamentals of bioengineering research topics and methodology for master's-level bioengineering students. Internal and external speakers discuss general topics in bioengineering, including the medical device qualification and regulatory environment, tissue engineering, cell engineering, mechanobiology, drug delivery, bioimaging, neuromotor control, and effective design of experiments. Each student is expected to read, critically evaluate, and present research in a peer-reviewed bioengineering journal article.

**BIOE 6100. Medical Physiology. (4 Hours)**

Designed to provide bioengineering students with a working knowledge of the integrated behavior of organs and systems in the human body. As such, the student is provided with a comprehensive and intense immersion in each physiological subsystem with the expectation that he or she display knowledge of each at the level equivalent to that of a second-year medical student following his or her exposure to physiology. The specific subsystems covered are muscle physiology, cardiovascular physiology with ECG interpretation, pulmonary physiology with gas exchange mechanics and ventilation/perfusion, renal physiology and water balance, regulation of pH, gastrointestinal physiology, temperature regulation and energy balance, endocrine systems, and reproductive systems. The course does not cover neurophysiology.

**BIOE 6200. Mathematical Methods in Bioengineering. (4 Hours)**

Offers an overview of quantitative techniques that students will encounter in their research, providing a language and a foundation for more specialized study. Introduces basic concepts from linear algebra, ordinary and partial differential equations, transforms, function approximation, probability, statistics, and numerical computation, illustrated by applications in biology and medicine.

**BIOE 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOE 7000. Principles of Bioengineering. (4 Hours)**

Designed to introduce new graduate bioengineering students to the fundamentals of bioengineering research topics and methodology. Includes outside speakers to discuss general topics in bioengineering. Examples of course topics include the medical device qualification and regulatory environment, tissue engineering, cell engineering, mechanobiology, drug delivery, bioimaging, neuromotor control, effective design of experiments, writing research proposals for the National Institutes of Health (NIH) and how to evaluate and write a peer-reviewed journal article, etc. Expects students to read, critically evaluate, and present the research in a bioengineering journal article. Students are then expected to extend their article into a hypothesis-driven proposal in NIH format with an oral defense of the proposal.

**BIOE 7210. A Data Science Toolkit for Human Neuroscience Research. (4 Hours)**

Introduces fundamental programming, statistics, and machine learning methods that underlie modern human neuroscience research. Emphasizes understanding how linear models form the building blocks for a wide range of commonly used methods, as well as application of these methods through standard scientific computing libraries. With hands-on learning, students use R and Python to work through projects tailored to real-world neuroimaging applications (e.g., fMRI, EEG). Applies basic statistical and machine learning analysis procedures for human neuroscience research with R and Python to understand fundamental considerations underlying their application.

**BIOE 7374. Special Topics in Bioengineering. (4 Hours)**

Offers topics of current interest in bioengineering. May be repeated up to nine times.

**BIOE 7390. Seminar. (0 Hours)**

Presents topics of an advanced nature by faculty, outside speakers, and students in the graduate program. May be repeated without limit.

**BIOE 7391. Student Seminar. (0 Hours)**

Offers students an opportunity to practice clear and concise oral communication of research to an audience of people with a variety of skills and differing expertise. This is an essential skill for anyone seeking a career in scientific research and beyond. It differs from communicating research to a group meeting or a conference presentation, which is comprised of audiences of fellow specialists who are already familiar with the field and its specialized terminology. Students instead present to a diverse, interdisciplinary group of peers (i.e., the Department of Bioengineering and other members of the Northeastern community). Maybe be repeated once.

**BIOE 7945. Master's Project. (4 Hours)**

Offers analytical and/or experimental work leading to a written report and a final short presentation by the end of the semester.

**BIOE 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOE 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated twice for up to 12 semester hours.

**BIOE 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**BIOE 7990. Thesis. (4 Hours)**

Offers analytical, research, and/or experimental work conducted under the auspices of the department.

**Prerequisite(s):** BIOE 7945 with a minimum grade of C-

**BIOE 7996. Thesis Continuation - Half-Time. (0 Hours)**

Continues thesis work conducted under the supervision of a departmental faculty.

**BIOE 8960. Exam Preparation—Doctoral. (0 Hours)**

Offers students an opportunity to prepare for the PhD qualifying exam under faculty supervision. Intended for students who have completed all required PhD course work and have not yet achieved PhD candidacy; students who have not completed all required PhD course work are not allowed to register for this course. May be repeated once.

**BIOE 8986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**BIOE 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of program requirements for PhD candidacy.

**BIOE 9986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision. May be repeated up to nine times.

**BIOE 9990. Dissertation Term 1. (0 Hours)**

Offers theoretical and/or experimental work conducted under the auspices of the department.

**Prerequisite(s):** BIOE 9000 with a minimum grade of S

**BIOE 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** BIOE 9990 with a minimum grade of S

**BIOE 9996. Dissertation Continuation. (0 Hours)**

Offers continued dissertation work conducted under the supervision of a departmental faculty member.

**Prerequisite(s):** BIOE 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Bioinformatics (BINF)

**BINF 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BINF 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BINF 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BINF 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BINF 5964. Projects for Professionals. (0 Hours)**

Offers students an applied project setting in which to apply their curricular learning. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review 'lessons learned,' and incorporate suggestions from this review to improve and further develop their career development and professional plan. May be repeated twice.

**BINF 5976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated twice.

**BINF 6200. Bioinformatics Programming. (4 Hours)**

Focuses on the fundamental programming skills required in the bioinformatics industry. Focuses on Python and R as the main programming language used. Topics include string operations, file manipulation, regular expressions, object-oriented programming, data structures, testing, program design, and implementation. Includes substantial out-of-classroom assignments.

**BINF 6201. Introduction to Bioinformatics Using RNA Sequencing. (4 Hours)**

Introduces RNA-Seq, a commonly used method for analyzing gene expression. Offers students an opportunity to obtain hands-on experience processing and analyzing high-throughput sequencing data, as well as exposure to NGS and RNA-Seq processes, applications, and terminology.

**BINF 6250. Algorithmic Foundations in Bioinformatics. (3 Hours)**

Explores algorithmic principles in the context of bioinformatics. Through a dynamic and comprehensive journey encompassing sequence alignment, genome assembly, phylogenetics, hidden Markov models, and predictive analyses in protein and RNA structures, delves into the core techniques essential for deciphering biological data. Uses lectures, hands-on sessions, and case studies to offer students an opportunity to obtain a rich understanding of how algorithms drive insights into evolutionary relationships, genetic patterns, and molecular structures.

**Prerequisite(s):** BINF 6200 with a minimum grade of C- or BINF 6200 with a minimum grade of C-

**BINF 6308. Bioinformatics Computational Methods 1. (4 Hours)**

Offers the first semester of a two-semester sequence on the use of computers in bioinformatics research. Offers students an opportunity to work with current methods and computational algorithms used in contemporary sequence analysis. Teaches practical skills necessary to manage and mine the vast biological information being generated and housed in public databases. Emphasizes the use of Python as the primary computer language and requires students to learn and understand basic computer logic and syntax, including an introduction to scalars, arrays, hashes, decision statements, loops, subroutines, references, and regular expressions. A focus on fundamental skills, including the command line interface found in the Linux operating system, is designed to prepare students for second-semester applications.

**BINF 6309. Bioinformatics Computational Methods 2. (4 Hours)**

Designed to build upon the core topics covered in BINF 6308, i.e., use of the computer as a tool for bioinformatics research. Builds upon the Python language fundamentals covered during the first semester but requires students to apply these fundamentals to a semester-long project. The project includes protein family analysis, multiple sequence analysis, phylogeny, and protein structure analysis. Additionally, students have an opportunity to learn to build, load, connect, and query custom MySQL databases, and parse command line flags.

**Prerequisite(s):** BINF 6308 with a minimum grade of C- or BINF 6308 with a minimum grade of C- or BIOL 6308 with a minimum grade of C-

**BINF 6310. Introduction to Bioinformatics. (4 Hours)**

Focuses on the core bioinformatics skill set and knowledge base necessary to conduct exploratory data analysis of large-scale biological data. Offers students an opportunity to work with the latest computational approaches in the context of real-world data and to obtain practical skills necessary to access, manage, and mine the vast biological information housed in public repositories. Presents core computational skills. Introduces DevOps concepts including version control, using Linux, as well as introductory CLI Logic and syntax related to pipeline development. Reviews basic molecular biology concepts and techniques necessary for contemporary bioinformatics analytical approaches. Examines similarities and differences among applications of next-generation sequencing and third-generation sequencing platforms. Covers sequence similarity analysis methods and related biological file formats.

**Prerequisite(s):** BINF 6200 (may be taken concurrently) with a minimum grade of C- or BINF 6200 (may be taken concurrently) with a minimum grade of C- or DS 2500 with a minimum grade of C-

**BINF 6400. Genomics in Bioinformatics. (4 Hours)**

Introduces the field of genomics. With the completion of the Human Genome Project several years ago, there has been an explosion of genetic data collected. Focuses on the bioinformatics tools necessary to analyze large-scale genomic data. Covers topics such as phylogenetic trees, molecular evolution, gene expression profiling, heterogeneous genomic data, as well as next-generation sequencing (NGS) data.

**Prerequisite(s):** ((BINF 6200 with a minimum grade of C- or BINF 6200 with a minimum grade of C- ); (BINF 6310 with a minimum grade of C- or BINF 6310 with a minimum grade of C- )) or ((BINF 6308 with a minimum grade of C- or BINF 6308 with a minimum grade of C- ); (BINF 6309 with a minimum grade of C- or BINF 6309 with a minimum grade of C- ))

**BINF 6420. Omics in Bioinformatics. (4 Hours)**

Focuses on some of the omics, other than genomics and proteomics, in relation to the bioinformatic tools that exist to analyze data. Provides a brief background on each field of study and then focuses on the current bioinformatics tools used. Topics include transcriptomics (transcription and gene expression), metabolomics (metabolism), glycomics (carbohydrates), lipomics (lipids), and phenomics (phenotypic data). Does not cover genomics and proteomics.

**Prerequisite(s):** ((BINF 6310 with a minimum grade of C- or BINF 6310 with a minimum grade of C- ); (BINF 6200 with a minimum grade of C- or BINF 6200 with a minimum grade of C- )) or ((BINF 6308 with a minimum grade of C- or BINF 6308 with a minimum grade of C- ); (BINF 6309 with a minimum grade of C- or BINF 6309 with a minimum grade of C- ))

**BINF 6430. Transcriptomics in Bioinformatics. (4 Hours)**

Introduces the study of the complete RNA transcriptome, otherwise known as “transcriptomics.” Covers the molecular genetics that underlie RNA and its various sequencing protocols (e.g., RNA-seq, ATAC-seq, and scRNA-seq), data preprocessing, transcriptome assembly, differential gene expression, and gene set enrichment analysis. Throughout the course and in collaboration with our academic partners, students take part in experiential learning by processing and analyzing various real-world RNA-seq datasets, including bulk RNA and single-cell sequencing.

**Prerequisite(s):** ((BINF 6310 with a minimum grade of C- or BINF 6310 with a minimum grade of C- ); (BINF 6200 with a minimum grade of C- or BINF 6200 with a minimum grade of C- )) or ((BINF 6308 with a minimum grade of C- or BINF 6308 with a minimum grade of C- ); (BINF 6309 with a minimum grade of C- or BINF 6309 with a minimum grade of C- ))

**BINF 6500. Professional Development for Co-op. (1 Hour)**

Introduces the cooperative education program. Offers students an opportunity to develop job-search and career-management skills; to assess their workplace skills, interests, and values and to discuss how they impact personal career choices; to prepare a professional resumé; and to learn proper interviewing techniques. Explores career paths, choices, professional behaviors, work culture, and career decision making.

**BINF 6511. Using Real-World Data to Advance Discovery in the Fields of Bioinformatics and Biotechnology. (3 Hours)**

Examines methodologies for analyzing observational health, viromics, and genetics datasets. Covers data structuring, collection methods, ethical considerations, statistical analysis techniques, and data visualization approaches in bioinformatics and biotechnology research. Offers experience with current bioinformatic tools and programs to address complex biological questions, from basic coding principles to advanced algorithmic applications. Analyzes large-scale health and genomic datasets, explore viral mutation patterns, and evaluate biopharmaceutical research applications.

**BINF 6900. Pre-Co-op Experience. (0 Hours)**

Offers students an opportunity to gain necessary skills and practical experience in order to prepare for graduate co-op.

**BINF 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**BINF 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BINF 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**BINF 6965. Co-op Work Experience Abroad. (0 Hours)**

Offers eligible students an opportunity for work experience abroad. May be repeated without limit.

**BINF 7700. Bioinformatics Research Directions. (4 Hours)**

Delves into the foundations of research planning and implementation in bioinformatics. Offers students an opportunity to learn experimental design and organization of the research process, as well as to develop the skills and techniques for writing, communication, and presentation of research work. Students work with a faculty member to design and conduct a short research project in the faculty member's area of research, present to different audiences, and construct a proposal for continuing their research.

**Prerequisite(s):** (BINF 6200 with a minimum grade of C- or BINF 6200 with a minimum grade of C- ); (BINF 6310 with a minimum grade of C- or BINF 6310 with a minimum grade of C- ); MATH 7340 with a minimum grade of C-

## Biology (BIOL)

### **BIOL 1000. Biology at Northeastern. (1 Hour)**

Introduces first-year students to the major and the field of biology and to the professional and academic resources available to students at Northeastern University; acquaints students with their faculty, advisors, and fellow students; provides an initial orientation to undergraduate research, cooperative education, and other experiential learning options; helps develop the academic skills necessary to succeed; provides grounding in the culture and values of the university community; and assists in interpersonal skill development—in short, familiarizes students with the resources and skills needed to become a successful university student.

### **BIOL 1107. Foundations of Biology. (4 Hours)**

Introduces evolutionary principles, cellular structure and function, genetic transmission, energy pathways, and physiology. Covers current topics in biology and evaluates and discusses current scientific literature. Explores the interdisciplinary nature of biology. Offers students an opportunity to prepare for the topical inquiries in biology courses.

**Corequisite(s):** BIOL 1108

### **BIOL 1108. Lab for BIOL 1107. (1 Hour)**

Accompanies BIOL1107. Includes various lab experiments that emphasize evolutionary principles, cellular structure and function, genetic transmission, energy pathways, and physiology.

**Corequisite(s):** BIOL 1107

### **BIOL 1111. General Biology 1. (4 Hours)**

Explores basic principles of biology with a focus on those features shared by all living organisms and seen through the lens of evolutionary theory. Through lectures, readings and discussion, offers students an opportunity to understand how the scientific method has been and is used to address biological questions. Central topics include recent advances in cell anatomy and physiology, including the interplay between organelles, membrane transport, and cell-signaling; energy transfer through cells and through the biosphere; cellular reproduction and cancer; heredity and human genetic disorders; and protein synthesis and biotechnology. Explores the societal implications of such topics as biopharmaceuticals, ocean acidification, climate change, human diseases, epigenetics, cancer, and cloning.

**Attribute(s):** NUpath Natural/Designed World

### **BIOL 1112. Lab for BIOL 1111. (1 Hour)**

Accompanies BIOL 1111. Offers students an opportunity to collect quantitative data through hands-on experimentation as well as simulations. Data is analyzed statistically and presented in written form.

**Prerequisite(s):** BIOL 1111 (may be taken concurrently) with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

### **BIOL 1113. General Biology 2. (4 Hours)**

Continues BIOL 1111. Examines the evolution of structural and functional diversity of organisms; the integrative biology of multicellular organisms; and ecological relationships at the population, community, and ecosystem levels.

**Prerequisite(s):** BIOL 1101 with a minimum grade of D- or BIOL 1107 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- or BIOL 1115 with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World

### **BIOL 1114. Lab for BIOL 1113. (1 Hour)**

Accompanies BIOL 1113. Covers topics from the course through various experiments.

**Prerequisite(s):** BIOL 1113 (may be taken concurrently) with a minimum grade of D-

### **BIOL 1141. Microbes and Society. (4 Hours)**

Introduces the unseen world of microorganisms. Students analyze how the growth and behavior of this diverse group of organisms affect many aspects of human society including agriculture and food preparation; drug development and manufacture; liquid and solid waste management; genetic engineering; geochemical cycles; and health and disease.

**Attribute(s):** NUpath Natural/Designed World

**BIOL 1143. Biology and Society. (4 Hours)**

Offers an overview of how biology weaves its way across a broad spectrum of complex societal issues. Introduces students to the biological mechanisms and processes responsible for genetic inheritance, energy transfer, evolution, and population dynamics, providing a framework within which students may critically interpret and discuss important biological information provided in public forums. Seeks to empower students to make informed choices at the policy and personal levels. Offers students an opportunity to acquire an understanding of the basic principles of biology and apply the scientific process to the analysis of contemporary issues. Using a thematic approach, covers a wide range of issues including the reemergence of plagues, biological weapons and security, the environment, and human health and wellness.

**Attribute(s):** NUpath Natural/Designed World

**BIOL 1147. The Human Organism. (4 Hours)**

Introduces the structure and function of the human body. Emphasizes the principles of biological and physical science as they relate to life processes in health and disease.

**Attribute(s):** NUpath Natural/Designed World

**BIOL 1149. Biology of Human Reproduction. (4 Hours)**

Studies sexual and reproductive function in the human male and female, that is, sexual development, coitus, fertilization, pregnancy, birth, and lactation. Discusses the methods of controlling fertility and sexually transmitted diseases. Analyzes factors affecting reproduction and sexuality in human population.

**Attribute(s):** NUpath Natural/Designed World

**BIOL 1153. Human Genome Editing: Science and Ethics. (4 Hours)**

Designed to familiarize students with the basic process of human genome editing, including an overview of emerging technologies that enable this process. Explores both sides of the ongoing ethical debate, including the potential benefits and limitations of human genome editing, and ramifications for this clinical practice on society. Introduces the methodology for genetic editing, a historical overview of the science and clinical practice of gene editing, and a synopsis of the current regulatory status. Discusses the ethical implications of the utilization of genome editing in humans. Offers students an opportunity to evaluate the utilization of genetic editing to eradicate genetically inherited diseases, the potential to create designer babies, and the socioeconomic impacts of gene editing.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Natural/Designed World

**BIOL 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOL 2217. Integrated Anatomy and Physiology 1. (4 Hours)**

Introduces students to integrated human anatomy and physiology. Focuses on structure and function of cells and tissues. Presents the anatomy and physiology of skin, bones, muscles, blood, and the nervous system.

**Corequisite(s):** BIOL 2218

**Attribute(s):** NUpath Natural/Designed World

**BIOL 2218. Lab for BIOL 2217. (1 Hour)**

Accompanies BIOL 2217. Covers topics from the course through various experiments.

**Corequisite(s):** BIOL 2217

**BIOL 2219. Integrated Anatomy and Physiology 2. (4 Hours)**

Continues BIOL 2217. Presents the structure and function of the human endocrine, reproductive, cardiovascular, respiratory, urinary, and digestive systems as well as the regulation of metabolism and body temperature.

**Prerequisite(s):** BIOL 1117 with a minimum grade of D- or BIOL 2217 with a minimum grade of D-

**Corequisite(s):** BIOL 2220

**Attribute(s):** NUpath Natural/Designed World

**BIOL 2220. Lab for BIOL 2219. (1 Hour)**

Accompanies BIOL 2219. Covers topics from the course through various experiments.

**Corequisite(s):** BIOL 2219

**Attribute(s):** NUpath Analyzing/Using Data

**BIOL 2221. Foundations of Microbiology. (4 Hours)**

Focuses on how to identify, control, and live with bacteria and viruses. Emphasizes the mechanisms of disease production, natural host defense systems, and medical interventions.

**Corequisite(s):** BIOL 2222

**BIOL 2222. Lab for BIOL 2221. (1 Hour)**

Accompanies BIOL 2221. Covers topics from the course through various experiments.

**Corequisite(s):** BIOL 2221

**BIOL 2299. Inquiries in Biological Sciences. (4 Hours)**

Focuses on the latest developments in the field. Offers students an opportunity to explore both scientific practice and progress through readings, discussion, and projects and to expand and deepen their understanding of fundamental biological principles.

**Prerequisite(s):** BIOL 1101 with a minimum grade of D- or BIOL 1107 with a minimum grade of D- or BIOL 1111 with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World

**BIOL 2301. Genetics and Molecular Biology. (4 Hours)**

Focuses on mechanisms of inheritance, gene-genome structure and function, and developmental genetics and evolution. Examples are drawn from the broad spectrum of plants, animals, fungi, bacteria, and viruses. Topics and analytical approaches include transmission genetics, molecular biology and gene regulation, DNA molecular methods, quantitative and population genetics, bioinformatics, genomics, and proteomics.

**Prerequisite(s):** (BIOL 1103 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- or BIOL 1115 with a minimum grade of D- or BIOL 2297 with a minimum grade of D- or BIOL 2299 with a minimum grade of D- or EEMB 1105 with a minimum grade of D- or EEMB 2290 with a minimum grade of D- or ENVR 2400 with a minimum grade of D- or EEMB 2400 with a minimum grade of D-); (CHEM 1211 with a minimum grade of D- or CHEM 1217 with a minimum grade of D- or CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D-)

**Attribute(s):** NUpath Natural/Designed World

**BIOL 2302. Lab for BIOL 2301. (1 Hour)**

Accompanies BIOL 2301. Reinforces and extends concepts presented and practiced in the accompanying lecture course through the application of scientific investigation methods and data analysis.

**Prerequisite(s):** BIOL 2301 (may be taken concurrently) with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**BIOL 2307. Research Exploration in Biology. (4 Hours)**

Introduces basic biological lab skills including lab safety, chemical handling, pipetting, and media preparation. Also introduces the fundamentals of experimental design, data analysis, and scientific communication. Provides an opportunity to explore authentic, current research questions in an immersive laboratory research experience. Coursework consists of team-based projects in which student groups design and execute biological experiments under the mentorship of Northeastern faculty and graduate students. Offers an opportunity to develop a research presentation and present experimental outcomes to fellow students, faculty, and staff.

**Prerequisite(s):** BIOL 2299 with a minimum grade of C-

**BIOL 2309. Biology Project Lab. (4 Hours)**

Offers an inquiry-based, intensive laboratory experience in which students have an opportunity to design and conduct independent research projects, applying approaches and techniques used in cell and molecular biology. Offers students an opportunity to present their results in professional formats.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Creative Express/Innov, NUpath Writing Intensive

**BIOL 2327. Human Parasitology. (4 Hours)**

Examines the general biology, life cycles, modes of transmission, and pathogenesis of major parasites on global human health. Explores a number of important diseases, along with the diverse protozoans, worms, and arthropods responsible for them.

**Prerequisite(s):** BIOL 1101 with a minimum grade of D- or BIOL 1107 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- or BIOL 1115 with a minimum grade of D-

**BIOL 2329. Bioethics. (4 Hours)**

Offers students an opportunity to explore ethical issues arising from biological research and emerging technologies, to learn to identify and critically analyze potential ethical implications of biological research, and to evaluate theory-based arguments while respectfully engaging with a diversity of perspectives. Using their knowledge of basic cellular and molecular science as a foundation, students have an opportunity to gain a deeper understanding of the biology of genome editing and other molecular and cellular biology-based technologies. Examines the history and ethical dialogue around genome editing as an in-depth example of an emerging technology with wide-ranging applications. Studies additional technologies with respect to research progress, international perspectives, and potential implications in the areas of security, environmental protection, and personal health.

**Prerequisite(s):** BIOL 1107 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- or BIOL 2299 with a minimum grade of D-

**Attribute(s):** NUpath Ethical Reasoning

**BIOL 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOL 2991. Research in Biology. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated seven times.

**BIOL 3401. Comparative Vertebrate Anatomy. (4 Hours)**

Examines the morphology and phylogeny of the vertebrates.

**Prerequisite(s):** BIOL 1103 with a minimum grade of D- or BIOL 1113 with a minimum grade of D- or BIOL 2297 with a minimum grade of D- or BIOL 2299 with a minimum grade of D- or ENVR 2290 with a minimum grade of D- or EEMB 2290 with a minimum grade of D-

**BIOL 3405. Neurobiology. (4 Hours)**

Introduces the cellular and molecular functioning of the nervous system, the organization of neurons into circuits, the processing of information, and the generation of motor output.

**Prerequisite(s):** BIOL 1103 with a minimum grade of D- or BIOL 1113 with a minimum grade of D- or BIOL 2297 with a minimum grade of D- or BIOL 2299 with a minimum grade of D- or ENVR 2290 with a minimum grade of D- or EEMB 2290 with a minimum grade of D- or PSYC 3458 with a minimum grade of D-

**BIOL 3409. Current Topics in Biology. (4 Hours)**

Examines selected topics in biology. Topics vary each semester. May be repeated without limit.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D

**BIOL 3411. Current Topics in Cell and Molecular Biology. (4 Hours)**

Examines selected topics in cell and molecular biology. Topics vary each semester. May be repeated without limit.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D-

**BIOL 3413. Current Topics in Organismal and Population Biology. (4 Hours)**

Examines selected topics in organismal and population biology. Topics vary each semester. May be repeated without limit.

**Prerequisite(s):** BIOL 1113 with a minimum grade of D- or BIOL 1115 with a minimum grade of D- or BIOL 2299 with a minimum grade of D- or EEMB 2400 with a minimum grade of D-

**BIOL 3415. Current Topics in Behavioral Neuroscience. (4 Hours)**

Examines selected topics in behavioral neuroscience. Topics vary each semester.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D-

**BIOL 3417. Bioethics of Human Genome Editing. (4 Hours)**

Presents an overview of emerging gene-editing technologies, explores ongoing ethical debates, describes the potential benefits and limitations of these technologies, and reviews the ramifications for this clinical practice on society. Topics include a scientific review of gene-editing methodologies, historical timeline for their development, clinical applications, the ethical and socioeconomic impacts, and regulatory status of these technologies. Offers students an opportunity to engage in scientific and ethical discourse, evaluate media reports of genome-editing technologies, and deeply probe a student-selected topic related to human genome editing through a writing project.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D-

**BIOL 3419. Engaging with Genomics: Ethics Law and Policy. (4 Hours)**

Focuses on the recent developments in human genetics and how they shape, and are shaped by, society. Topics include several of the most important social and legal aspects of genomic research, including the impact of new technologies on reproduction and kinship, gene editing and enhancement, genetic privacy, race and genomics, and the effects of gene patenting on research and pharmaceutical development. Explores questions related to the responsible conduct of genetic testing and research in human populations, practices of eugenics, rights of stakeholders during genetic testing, the patenting of human genes, and how concepts of race are being used in genetic research and in direct-to-consumer genomics.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D-

**BIOL 3421. Microbiology. (4 Hours)**

Introduces morphological, ecological, and biochemical consideration of representative groups of bacteria. Introduces virology and microbial genetics; host-parasite relationships, prokaryotes of medical significance; and physical and chemical controls of microbial growth.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D-

**Corequisite(s):** BIOL 3422

**Attribute(s):** NUpath Writing Intensive

**BIOL 3422. Lab for BIOL 3421. (1 Hour)**

Accompanies BIOL 3421. Covers topics from the course through various experiments.

**Corequisite(s):** BIOL 3421

**BIOL 3423. Animal Models in Biomedical Research. (4 Hours)**

Seeks to familiarize students with the use of animal models in research. Emphasizes specific animal models for physiology through a detailed survey of popular and alternative animal model systems. Covers legislation; ethics; the 3Rs (replacement, reduction, and refinement of animals used in research); and the current principles that guide animal research; as well as study design and statistical analysis and animal model selection. Includes reading assignments from media reports and primary scientific literature. Requires a final report in the form of a formal protocol detailing the use of animal models, including animal model selection, description of methodology, and application of statistics to animal modeling.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D-

**BIOL 3601. Neural Systems and Behavior. (4 Hours)**

Reviews major experimental approaches and key concepts used in behavioral neurobiology. Begins with a look at its history. Topics covered include spatial orientation and sensory guidance, neuronal control of motor output, neuronal processing of sensory information, sensorimotor integration, neuromodulation, circadian rhythms and biological clocks, behavioral physiology of large-scale navigation, neurobiology of communication, and cellular mechanisms of learning and memory.

**Prerequisite(s):** BIOL 3405 with a minimum grade of D- or PSYC 3458 with a minimum grade of D-

**BIOL 3603. Mammalian Systems Physiology. (4 Hours)**

Designed to familiarize students with fundamental principles in mammalian physiology. Emphasizes major organ systems integration. Where applicable, explores and uses human physiology to reinforce principles in physiology and build upon these principles by analyzing how major organ systems effectively network for proper organismal function. Initially covers the physiological principles of energy and metabolism in mammals, including human adaptation for basic energy requirements, and then delves into basics of membrane transport. Evaluates roles for organ systems integration in the respiratory, cardiovascular, gastrointestinal, hemopoietic, renal, and reproductive systems.

**Prerequisite(s):** BIOL 2301 (may be taken concurrently) with a minimum grade of D-

**BIOL 3605. Developmental Neurobiology. (4 Hours)**

Covers the cellular, molecular, and genetic processes that guide neural development. Focuses on how nerve cells are generated, patterned, and connected with one another to regulate animal behavior. Topics include cell differentiation, tissue patterning, neural plasticity, and cognitive development.

**Prerequisite(s):** BIOL 2301 (may be taken concurrently) with a minimum grade of D-

**BIOL 3607. Current Trends in Reproductive Sciences. (4 Hours)**

Introduces current trends in the field of reproductive sciences, spanning basic human reproduction, infertility, and potential horizons in medicine. Surveys topics in basic research that have the most promise to make an impact in the field of women's health. Emphasizes human health but includes animal models in the analysis.

**Prerequisite(s):** BIOL 2301 (may be taken concurrently) with a minimum grade of D-

**BIOL 3611. Biochemistry. (4 Hours)**

Covers structure and function of biomolecules, central concepts of bioenergetics and thermodynamics, enzyme kinetics and regulation, and metabolic pathways.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D- ; (CHEM 2313 with a minimum grade of D- or CHEM 2317 with a minimum grade of D- )

**Corequisite(s):** BIOL 3612

**BIOL 3612. Lab for BIOL 3611. (1 Hour)**

Accompanies BIOL 3611. Covers topics from the course through various experiments.

**Corequisite(s):** BIOL 3611

**BIOL 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOL 4701. Biology Capstone. (4 Hours)**

Integrates and assesses the concepts and skills obtained from the entire biology curriculum, including experiential and classroom-based components. Requires reflection by students on their various educational experiences, extensive research of scientific questions related to these experiences, and development of an original research proposal. Offers students an opportunity to hone communication skills through formal and informal presentations, class discussion, and critique.

**Prerequisite(s):** ENGW 3307 with a minimum grade of C or ENGW 3315 with a minimum grade of C or ENGW 3302 with a minimum grade of C

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**BIOL 4705. Neurobiology of Cognitive Decline. (4 Hours)**

Introduces the neuroanatomical and cognitive sequelae of brain aging and neurodegenerative disease. Covers molecular and cellular processes that damage neurons, animal models, and brain imaging. Explores higher-level manifestations of damage to, for example, memory, language, and reward systems.

**Prerequisite(s):** BIOL 3405 with a minimum grade of D- or PSYC 3458 with a minimum grade of D-

**BIOL 4707. Cell and Molecular Biology. (4 Hours)**

Integrates molecular biology and biochemistry in the cellular context. Focuses on the organization and function of eukaryotic cells, including the regulation of nuclear structure and gene expression, signal transduction, protein synthesis and growth, cellular energetics, the cytoskeleton and cell motility, cell division, and cell death. Emphasizes the scientific methodologies and approaches that underlie discovery in cell biology.

**Prerequisite(s):** BIOL 2323 with a minimum grade of D- or BIOL 3611 with a minimum grade of D-

**BIOL 4709. Neurobiology of Learning and Memory. (4 Hours)**

Explores the neurobiology of learning and memory from the level of the synapse up to the neural systems underlying emergent mnemonic function. Topics include the synaptic mechanisms underlying neural plasticity; the molecular basis of mnemonic processes; and the neural circuits serving distinct memory systems. In addition to lecture-based material, students utilize primary research and review articles from the current scientific literature to evaluate data and develop hypotheses via oral presentations and active discussions in the classroom. The overarching goal of the course is to provide a neurobiological perspective on how information is encoded, consolidated, and later retrieved and the significance of dysfunction in these processes associated with neurologic deficits and disease.

**Prerequisite(s):** PSYC 3458 with a minimum grade of D- or BIOL 3405 with a minimum grade of D-

**BIOL 4900. Biology Research Capstone. (1 Hour)**

Offers a capstone experience for biology majors who are concurrently registered for BIOL 4991 or BIOL 4994, in which they are conducting original research under the guidance of an approved mentor. Students conduct a literature search, write a research proposal, conduct the proposed research (in the context of the concurrent 4-SH research course), orally present the research, and produce a final research report. Requires students to reflect on and integrate their prior learning, participate in peer feedback, and revise their work in response to peer and instructor feedback.

**Prerequisite(s):** (ENGW 3307 with a minimum grade of D- or ENGW 3315 with a minimum grade of D- ); (BIOL 4991 (may be taken concurrently) with a minimum grade of D- or BIOL 4994 (may be taken concurrently) with a minimum grade of D- )

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**BIOL 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated without limit.

**BIOL 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field.

**Prerequisite(s):** ENGW 3307 with a minimum grade of D- ; (BIOL 4970 with a minimum grade of D- or BIOL 4991 with a minimum grade of D- or BIOL 4992 with a minimum grade of D- )

**Attribute(s):** NUpath Capstone Experience, NUpath Integration Experience, NUpath Writing Intensive

**BIOL 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOL 4991. Research. (4 Hours)**

Offers independent laboratory research work on a chosen topic under the direction of members of the department. Course content depends on instructor. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**BIOL 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work.

**Attribute(s):** NUpath Integration Experience

**BIOL 5100. Biology Colloquium. (1 Hour)**

Offers a series of colloquia in biological research by invited experts on current topics. May be repeated without limit.

**BIOL 5301. Clinical Embryology. (4 Hours)**

Designed to familiarize students with core biological processes associated with fertilization and early embryogenesis in humans, with an emphasis on clinical relevance. Covers fundamental aspects of female fertility and embryo development, including hormonal control of ovarian follicle growth and ovulation, fertilization, preimplantation embryonic development, implantation, and postimplantation embryonic development through gastrulation. Examines current parameters for determining egg and embryo quality. Additionally, discusses evolving stem-cell-based strategies for the treatment of female reproductive failure.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D- or graduate program admission

**BIOL 5306. Biological Clocks. (4 Hours)**

Examines the expression of endogenously generated twenty-four-hour (circadian) rhythms in eukaryotic life, emphasizing theoretical foundations as well as current research strategies for understanding how biological clocks work. Presents analytic principles essential for understanding biological rhythmicity in any organism at any level of organization. Emphasizes strategies used to understand the concrete mechanisms underlying biological rhythmicity.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D- or graduate program admission

**BIOL 5535. Expanding Frontiers: Vector-Borne Diseases. (4 Hours)**

Explores the biology of vectors and vector-borne infectious diseases. The World Health Organization estimates that about one-fifth of all infectious diseases are caused by vector-borne diseases. Vectors discussed include mosquitoes; ticks; Plasmodium; trypanosomes; Lyme disease-causing bacteria; and arboviruses such as dengue, yellow fever, West Nile, and Zika. Examines the development, metabolism, behavior, and symbiotic relationships—including the vector-host-pathogen relationships—through a student-generated literature review and a research proposal. Thoroughly reviews treatments and prevention strategies ranging from vaccination, pre- and postexposure prophylaxis, antimicrobial intervention, management of sequelae, and vector-control strategies. Discusses each topic from the perspective of historical and modern research.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D- or graduate program admission

**BIOL 5539. Advances in Genome Editing. (4 Hours)**

Analyzes the scientific literature to investigate the rapidly changing field of genome editing and identify the implications for biological sciences. Explores developments in genome editing along with the clinical and experimental applications of these tools. Life sciences have been revolutionized by the emergence of technologies that enable precise alterations in DNA sequences, cells, model organisms, and even humans.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D- or graduate program admission

**BIOL 5541. Endocrinology. (4 Hours)**

Explores the endocrine regulation of physiological systems, emphasizing current research. Lectures provide background, followed by analysis of primary literature and case studies. Topics include growth, reproduction, nutrient utilization, stress, and environmental endocrine disruption. Emphasizes humans but includes material on other animals, including invertebrates.

**Prerequisite(s):** BIOL 2319 with a minimum grade of D- or BIOL 2323 with a minimum grade of D- or BIOL 3405 with a minimum grade of D- or BIOL 3611 with a minimum grade of D- or BIOL 4707 with a minimum grade of D- or graduate program admission

**BIOL 5543. Stem Cells and Regeneration. (4 Hours)**

Explores the biological basis of embryonic, adult, and induced pluripotent stem cells toward an understanding of their roles in development, homeostasis, and regeneration, as well as their therapeutic potential. The study of stem cells is a rapidly advancing area in biology and biomedicine. Although the biological basis of stem cells is a major focus, the course aims to put this knowledge into a biomedical context.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D- or graduate program admission

**BIOL 5549. Inventions in Microbial Biotechnology. (4 Hours)**

Offers readings and seminar-style discussion from the current literature on important inventions and practical applications in biotechnology, with a focus on microbiome and antibiotic discovery, emphasizing new concepts.

**BIOL 5573. Medical Microbiology. (4 Hours)**

Emphasizes host-parasite interactions: virulence, toxins, natural flora, and immunological responses; characteristics of the common bacterial, rickettsial, and protozoal infections in humans; and epidemiology, pathology, vaccines, and chemotherapy.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D- or graduate program admission

**BIOL 5581. Biological Imaging. (4 Hours)**

Illustrates imaging principles and techniques and their application to biological problems. Topics vary and may include microscopic and macroscopic approaches in areas such as cellular and neurobiology, ecology, and biochemistry.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D- or graduate program admission

**BIOL 5583. Immunology. (4 Hours)**

Provides an overview of the structure and function of genes, proteins, and cells involved in the generation of the immune response. Emphasis is on molecular immunology and immunogenetics.

**Prerequisite(s):** BIOL 2323 with a minimum grade of D- or BIOL 3611 with a minimum grade of D- or graduate program admission

**BIOL 5585. Evolution. (4 Hours)**

Discusses history of evolutionary theory and lines of evidence. Emphasis is on mechanisms of speciation. Introduces and discusses current evolutionary topics.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D- or graduate program admission

**BIOL 5587. Comparative Neurobiology. (4 Hours)**

Presents a cellular approach to structure and function of the nervous system. Topics include neuronal anatomy, phylogeny of nervous systems, electrophysiology of membrane conductances, synaptic transmission, integration in nerve cells, neuronal networks, sensory systems, motor systems, sensory-motor integration, development and regeneration of neuronal connectivity, and fundamentals of neurotechnology for biomedics. Focuses on the development of these concepts from the primary research literature. A term project involves the design of a simple nervous system for a hypothetical animal.

**Attribute(s):** NUpath Creative Express/Innov

**BIOL 5591. Advanced Genomics. (4 Hours)**

Intended for those familiar with the basics of genetics, molecular and cellular biology, and biochemistry, all of which are required to appreciate the beauty, power, and importance of modern genomic approaches. Introduces the latest sequencing methods, array technology, genomic databases, whole genome analysis, functional genomics, and more.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D- or graduate program admission

**BIOL 5593. Cell and Molecular Biology of Aging. (4 Hours)**

Covers the recent scientific discoveries that have transformed our understanding of the process of aging. Examines in-depth the current understanding of the molecular mechanisms that control life span in model organisms, including yeast, worms, flies, and mice. Discusses dietary interventions and pharmacological approaches that extend the life span and delay the onset of age-related diseases. Covers potential applications of the new science of aging to improve human health. Requires students to read, discuss, present, and report on primary research papers from the literature.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D- or graduate program admission

**Attribute(s):** NUpath Writing Intensive

**BIOL 5595. Cell and Molecular Neuroscience. (4 Hours)**

Combines molecular biology, cell biology, pharmacology, and genetics to address the fundamental molecular properties of neurons and neuronal networks. At its core, the principles that govern the communication between cells of the nervous system are determined by their molecular components. The molecular landscape defines the individual properties of a neuron and the function of neuronal networks as a whole. Focuses on neuronal signaling through the function of ion channels and receptors, supramolecular mechanisms like synaptic transmission and axonal transport, and the molecular mechanisms that underlie biological networks and neural coding of information. Uses the fundamental understanding of molecular networks as a framework to explore the mechanisms that underlie neurological diseases and disorders. Discusses current treatments and therapies that rely on modulating neuronal signaling through molecular interactions.

**Prerequisite(s):** (BIOL 2301 with a minimum grade of D- ; (PSYC 3458 with a minimum grade of D- or BIOL 3405 with a minimum grade of D- )) or graduate program admission

**BIOL 5597. Immunotherapies of Cancer and Infectious Disease. (4 Hours)**

Describes the basic principles and the current promises and disappointments with immunotherapies of cancer. Provides a historical overview of the main barriers between tumors and antitumor killer cells. The unifying focus of the lectures is the role of immunological and physiological negative regulators, i.e., "brakes" of anti-tumor immune response. A significant part of the course is dedicated to the retrospective evaluation of the last three decades of the immunological and biochemical studies that culminated in identification of the "chief of tumor defense operations," i.e., a hypoxia-adenosinergic pathway in the tumor microenvironment.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D- or graduate program admission

**BIOL 5601. Multidisciplinary Approaches in Motor Control. (4 Hours)**

Studies the field of human motor control, or motor neuroscience. Offers students an opportunity to obtain a fundamental understanding of the processes underlying the acquisition and control of sensorimotor behavior. The systems approach connects a variety of disciplines ranging from neurophysiology, to engineering, to neurorehabilitation. Reviews a selection of approaches with emphasis on motor learning. Focuses on early behavioral approaches, more recent neurophysiological and imaging approaches, and rehabilitation. Discusses selected representative papers, including seminal historical papers and more recent studies reflecting the current discussion in the field.

**Prerequisite(s):** (BIOL 2301 with a minimum grade of D- ; (PSYC 3458 with a minimum grade of D- or BIOL 3405 with a minimum grade of D- )) or graduate program admission

**BIOL 5821. Cell and Gene Therapies. (4 Hours)**

Presents a comprehensive overview of the most recent clinical approaches in treating previously known incurable diseases. Focuses on an introduction to cell and gene therapy, how gene therapies are developed to treat some rare and genetic diseases, different modalities of in vivo and ex vivo gene therapy (cell therapy), the delivery of genetic materials to the cells, limitations, and more. Offers students an opportunity to learn about CAR T-cell therapy, different types of viruses (AAVs and retroviruses), nanoparticles, CRISPR-Cas9, RNA interference(RNAi), and many more tools in this fast-paced field.

**BIOL 6216. Applied Bioinformatics. (4 Hours)**

Introduces a foundational understanding of bioinformatics. Emphasizes computational techniques and programming skills essential for analyzing biological data. Covers key bioinformatics concepts such as data types, databases, and algorithms for genomic data analysis, including sequencing. Offers students an opportunity to gain experience with tools used in the analysis of genetic data by engaging with real-world applications in genetic modification and therapeutic genome editing.

**BIOL 6299. Molecular Cell Biology for Biotechnology. (3 Hours)**

Integrates biochemistry and molecular biology in the cellular context. Includes the organization and replication of genomes, principles and methods for genetic manipulation, the regulation of gene expression, and the structure and function of organelles. Emphasizes protein synthesis, including translation, post-translational modifications, and translocations of proteins within the cells and secretion.

**BIOL 6300. Biochemistry. (4 Hours)**

Studies the structure and function of biomolecules, with an emphasis on proteins; enzyme catalysis; and cellular metabolism, with an emphasis on bioenergetics and carbohydrate/lipid.

**BIOL 6301. Molecular Cell Biology. (4 Hours)**

Integrates biochemistry and molecular biology in the cellular context. Emphasizes the organization and replication of genomes, the regulation of gene expression, the structure and function of organelles, and the mechanisms of signal transduction.

**Prerequisite(s):** BIOL 6300 with a minimum grade of C-

**BIOL 6303. Neurobiology and Behavior. (4 Hours)**

Provides a comprehensive overview of behavioral neurobiology, emphasizing a neuroethological approach. Fosters a contemporary understanding of the historical development of the behavioral sciences, the major ethological and neurobiological concepts, and the principal mechanisms that govern behavior in animals and humans.

**BIOL 6381. Ethics in Biological Research. (2 Hours)**

Discusses ethical issues relevant to research in the biological sciences. Requires student presentations.

**BIOL 6405. Prokaryotic Cell and Molecular Biology. (4 Hours)**

Provides in-depth discussion about fundamentally important cellular processes in prokaryotic systems—such as replication, transcription, and translation—and the corresponding regulatory mechanisms. Also discusses molecular mechanisms of gene regulation and bacterial pathogenesis, using selected examples and mechanisms of prokaryotic cell signaling, and advanced and high-throughput techniques used in prokaryotic molecular and cell biology.

**BIOL 6407. Biochemistry for Molecular Biologists. (4 Hours)**

Focuses on the interface between molecular biology, molecular genetics, and biochemistry. Concentrates on biochemical problems that molecular biologists are likely to find in their research. Includes examples of prokaryotic and eukaryotic (whenever available) systems. Experimental approaches are discussed for all topics. Seeks to enable students to develop a deep understanding of concepts in biological systems through reading and discussion of the primary literature.

**BIOL 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOL 7399. Research Problem Solving, Ethics, and Communication Skills. (4 Hours)**

Focuses on research problem-solving skills, including formulation of hypotheses; experimental design, execution, and analysis; and research ethics. Offers instruction in scientific writing, including daily record keeping, grants and papers, and oral communication skills. Discusses the use and misuse of statistics and discusses responsibility to the public. Requires permission of instructor for those students not enrolled in biology.

**BIOL 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOL 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**BIOL 7990. Thesis. (1-4 Hours)**

Offers thesis supervision by members of the department. May be repeated without limit.

**BIOL 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers continuing thesis supervision by members of the department.

**BIOL 8420. Biological Lab Rotation 1. (4 Hours)**

Offers experience in biology research in a faculty research laboratory. Intended only for students who have not yet chosen a lab in which to carry out dissertation/thesis work.

**BIOL 8960. Exam Preparation—Doctoral. (0 Hours)**

Offers the student the opportunity to prepare for the PhD qualifying exam under faculty supervision.

**BIOL 8982. Readings. (1-4 Hours)**

Offers readings from current literature on an area of interest to students and faculty. May be repeated without limit.

**BIOL 8984. Research. (1-4 Hours)**

Focuses on research methods and their application to a specific problem under the direction of a graduate faculty member. May be repeated without limit.

**BIOL 8986. Research. (0 Hours)**

Offers the student the opportunity to conduct full-time research. May be repeated without limit.

**BIOL 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**BIOL 9984. Research. (1-4 Hours)**

Focuses on research methods and their application to a specific problem under the direction of a graduate faculty member. May be repeated without limit.

**BIOL 9990. Dissertation Term 1. (0 Hours)**

Offers theoretical and experimental research for the PhD degree.

**Prerequisite(s):** BIOL 9000 with a minimum grade of S

**BIOL 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** BIOL 9990 with a minimum grade of S

**BIOL 9996. Dissertation Continuation. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** BIOL 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Biology - CPS (BIO)

**BIO 1050. Medical Terminology. (3 Hours)**

Offers students an opportunity to explore the language of medicine, learning about the importance of word structure in medical fields. A command of medical terminology is fundamental for anyone who aspires to work in the healthcare field. Examines the fundamentals of word analysis and construction, including root words, prefixes, and suffixes, all in the context of the anatomy and physiology of human body systems and healthcare systems. Seeks to provide the fundamentals of science and medicine through reading, writing, listening, and speaking exercises focusing on technical terms used in medical terminology.

**BIO 1100. Principles of Biology 1. (3 Hours)**

Introduces a variety of biological concepts. Surveys plant and animal characteristics by comparing cell structure and function. Examines specific elements of structure, function, and natural history. Specific topics include cytology, histology, physiology, genetics, cellular respiration, and botany.

**Corequisite(s):** BIO 1101

**Attribute(s):** NUpath Natural/Designed World

**BIO 1101. Lab for BIO 1100. (1 Hour)**

Accompanies BIO 1100. Studies the specialization of animal cells and ecological succession. Offers students an opportunity to learn about proper experimental design and the limits of experimentation. Includes observing the structure and function of unicellular organisms and the characteristics of biological molecules, measuring aerobic and anaerobic respiration rates, observing cellular reproduction, and genetic analysis of plants and animals.

**Corequisite(s):** BIO 1100

**BIO 1200. Principles of Biology 2. (3 Hours)**

Covers the major evolutionary trends leading to complex life forms. Surveys organisms beginning with unicellular algae and leading to basic animal structure and function. Describes the anatomy of each body system as well as physiological processes such as hormonal control, nerve impulse transmission, muscular contraction, and the immune response.

**Prerequisite(s):** BIO 1100 with a minimum grade of D- ; BIO 1101 with a minimum grade of D-

**Corequisite(s):** BIO 1201

**Attribute(s):** NUpath Natural/Designed World

**BIO 1201. Lab for BIO 1200. (1 Hour)**

Accompanies BIO 1200. Uses prepared slides and preserved specimens to study the Prostitia and animal kingdoms. Studies the appendicular and axial bones, muscles, blood vessels, urogenital anatomy, and the nervous system.

**Prerequisite(s):** BIO 1100 with a minimum grade of D- ; BIO 1101 with a minimum grade of D-

**Corequisite(s):** BIO 1200

**BIO 1600. Human Anatomy and Physiology 1. (3 Hours)**

Provides an overview of anatomic terminology and organization of the body. Presents the structure and function of cells and tissues. Includes the anatomy and physiology of the integumentary and musculoskeletal systems, joint structure and function, and the nervous and endocrine systems, including special senses.

**Prerequisite(s):** BIO 1200 with a minimum grade of D- ; BIO 1201 with a minimum grade of D-

**Corequisite(s):** BIO 1601

**Attribute(s):** NUpath Natural/Designed World

**BIO 1601. Lab for BIO 1600. (1 Hour)**

Accompanies BIO 1600. Covers a range of topics from the course.

**Prerequisite(s):** BIO 1200 with a minimum grade of D- ; BIO 1201 with a minimum grade of D-

**Corequisite(s):** BIO 1600

**BIO 1700. Human Anatomy and Physiology 2. (3 Hours)**

Covers the structure and function of the cardiovascular system (including the properties of blood, the lymphatic system, and immunity) and the respiratory, digestive, and urogenital systems.

**Prerequisite(s):** BIO 1600 with a minimum grade of D- ; BIO 1601 with a minimum grade of D-

**Corequisite(s):** BIO 1701

**Attribute(s):** NUpath Natural/Designed World

**BIO 1701. Lab for BIO 1700. (1 Hour)**

Accompanies BIO 1700. Covers a range of topics from the course.

**Prerequisite(s):** BIO 1600 with a minimum grade of D- ; BIO 1601 with a minimum grade of D-

**Corequisite(s):** BIO 1700

**BIO 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIO 2100. Microbiology. (3 Hours)**

Emphasizes the close relationship between the development of technology and science. Compares prokaryotic and eukaryotic cellular morphology and physiology, including bioenergetics, carbohydrate metabolism, and cellular nutrition and growth. Studies viral replication, microbial genetics, bacterial taxonomy, and evolution. Discusses the principles of epidemiology and public health related to food, water, and sewage microbiology and the role of microbes in fermentation and industrial and environmental microbiology.

**Prerequisite(s):** BIO 1200 with a minimum grade of D- ; BIO 1201 with a minimum grade of D-

**Corequisite(s):** BIO 2101

**BIO 2101. Lab for BIO 2100. (1 Hour)**

Accompanies BIO 2100.

**Prerequisite(s):** BIO 1200 with a minimum grade of D- ; BIO 1201 with a minimum grade of D-

**Corequisite(s):** BIO 2100

**BIO 2300. Cell Biology. (3 Hours)**

Introduces the chemical composition and structure of cells and organelles. Focuses on transport processes, cell cycle and cell death, and cytoskeleton and matrix. Includes cellular control systems, including cellular energy supply, action of chemical messengers and regulators, cellular principles of respiration, and photosynthesis.

**Prerequisite(s):** BIO 1200 with a minimum grade of D- ; BIO 1201 with a minimum grade of D-

**BIO 2500. Genetics and Molecular Biology. (3 Hours)**

Covers a detailed analysis of the biochemical mechanisms that control the maintenance, expression, and evolution of prokaryotic and eukaryotic genomes. Topics covered in lectures and readings of relevant literature include gene regulation, DNA replication, genetic recombination, and mRNA translation. Emphasizes the logic of experimental design and data analysis.

**Prerequisite(s):** BIO 1200 with a minimum grade of D- ; BIO 1201 with a minimum grade of D-

**Corequisite(s):** BIO 2501

**BIO 2501. Lab for BIO 2500. (1 Hour)**

Accompanies BIO 2500.

**Prerequisite(s):** BIO 1200 with a minimum grade of D- ; BIO 1201 with a minimum grade of D-

**Corequisite(s):** BIO 2500

**BIO 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIO 3100. Biochemistry. (3 Hours)**

Covers the fundamental chemistry of biomolecules such as proteins, enzymes, lipids, carbohydrates, and nucleotides. Studies important molecular structures and their role in metabolic cycles. Introduces metabolism and catabolic and anabolic pathways of carbohydrates, lipids, proteins, and nucleotide metabolism. Discusses the importance of nutrition and how it affects metabolic pathways, genetic disorders, and mechanisms of action of various drugs that affect these pathways.

**Prerequisite(s):** BIO 1200 with a minimum grade of D- ; BIO 1201 with a minimum grade of D-

**Corequisite(s):** BIO 3101

**Attribute(s):** NUpath Writing Intensive

**BIO 3101. Lab for BIO 3100. (1 Hour)**

Accompanies BIO 3100. Introduces modern research techniques used in biochemistry. Topics include purification and characterization of proteins, kinetic properties of enzymes, isolation of high-molecular-weight DNA, and protein separation; DNA mapping; spectrophotometry; peptide mapping and sequencing; enzyme kinetics; and extraction, separation, and isolation techniques.

**Prerequisite(s):** BIO 1200 with a minimum grade of D- ; BIO 1201 with a minimum grade of D-

**Corequisite(s):** BIO 3100

**BIO 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIO 4215. Human Parasitology. (3 Hours)**

Examines the general biology, life cycles, modes of transmission, and pathogenesis of major parasites on global human health. Explores a number of important diseases, along with the diverse protozoans, worms, and arthropods responsible for them.

**Prerequisite(s):** BIO 1200 with a minimum grade of D- ; BIO 1201 with a minimum grade of D-

**BIO 4955. Project. (1-4 Hours)**

Offers students an opportunity to prepare a discipline-specific project. May be repeated without limit.

**BIO 4983. Topics. (1-4 Hours)**

Covers special topics in biology. May be repeated without limit.

**BIO 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Biotechnology (BIOT)

**BIOT 5120. Foundations in Biotechnology. (3 Hours)**

Provides an interdisciplinary, state-of-the-art introduction to biotechnology. Covers the molecular foundations of biotechnology, molecular microbiology, receptor pharmacology, drug development processes, biotech process development and scale-up, drug approval and regulatory affairs, genomics, microarray analysis, proteomics, computational biology, molecular modeling, analytical biotechnology, and bioterrorism and biotechnology.

**BIOT 5145. Biotechnology Lab Skills. (1 Hour)**

Introduces selected key skills and techniques central to life sciences research. Combines hands-on training in basic laboratory skills with lecture and live demonstration. Laboratory exercises highlight the importance of precision/accuracy in dispensation of liquids and in the preparation of solutions and standards, documentation and record keeping, and maintaining a safe and sterile work environment while performing scientific research.

**BIOT 5219. The Biotechnology Enterprise. (2 Hours)**

Exposes students to the business of biotech from scientific discovery startup through its product launch and subsequent organizational and scientific pipeline growth. Topics include scientific discovery, biotech-related funding and organizational structures, regulatory and clinical trial considerations, biotech alliances, patient access, ethics and compliance, and commercialization and growth while meeting unmet patient or consumer needs in this highly regulated industry. Although the focus is on the highest regulated standards in biopharma, the course also touches upon various aspects of other biotechnology domains.

**BIOT 5220. The Role of Patents in the Biotechnology Industry, Past and Future. (1 Hour)**

Covers the basics of patenting and the application of patents to the biotechnology industry, including the controversial area of gene patents.

**BIOT 5225. Managing and Leading a Biotechnology Company. (3 Hours)**

Covers managing projects and personnel in a technology-based organization. Such activities are best carried out by those who combine the technical knowledge of their industry with the insight into the best practices for working with groups of highly educated, and often very experienced people. The biotechnology industry is strongly dependent on the concept that knowledge is always shared and ownership is collective. As the fundamental organizational mantra is teamwork, the principles of managing in this environment are key to achieving important goals. How to accomplish this and make decisions that drive innovation and success have common threads with other technology based industries, but with the added complexity of the scientific challenges facing the biotechnology industry. Restricted to students in the Bouvé College of Health Sciences and in the College of Science or by permission of the program office.

**Prerequisite(s):** BIOT 5219 with a minimum grade of C-

**BIOT 5227. Launching Your Science: Biotechnology Entrepreneurship. (3 Hours)**

Focuses on the essential startup elements that lead to pitching your science to investors and funding your biopharmaceutical enterprise. Exposes students to the basics of establishing an unmet patient need and matching that to a scientific discovery or biotechnology platform, analyzing the marketplace from a scientific perspective, determining a draft regulatory pathway and product development plan through a target product profile (TPP), appropriately sizing and hiring your early stage management team, and assessing the financial needs and risks for appropriate exit strategies. Students produce a baseline pitch deck as the culminating project for the course.

**Prerequisite(s):** BIOT 5219 with a minimum grade of C-

**BIOT 5228. Planning and Executing Biotechnology Projects. (3 Hours)**

Introduces the concepts, principles, and practices of project planning and execution. Emphasizes biotechnology sectors including human health, environment, and agri-food biotechnology. Explores the importance of managing projects and project teams in situations unique to the biotechnology industry including research and development, contract research, and technology transfer. Covers project management systems, tools, and professional codes of conduct and ethics. Requires application of course concepts to a relevant project, emphasizing development of professional skills in effective teamwork, leadership, and managing projects.

**Prerequisite(s):** BIOT 5219 with a minimum grade of C- or BIOT 5219 with a minimum grade of C- or BIOT 5219 with a minimum grade of C-

**BIOT 5330. Drug Safety and Immunogenicity. (3 Hours)**

Introduces the fundamental molecular interactions involved in immunological responses as well as in measuring and testing in a research and regulated environment. Other drug-safety-related topics include adventitious agents (viruses, microorganisms, mycoplasma) and risk factors such as product-related substances (aggregates and post-translationally modified variants), endotoxins, DNA, host-cell proteins, process contaminants such as antibiotics, and the means of testing and removing these through validated processes.

**BIOT 5340. Introduction to Biotherapeutic Approvals. (3 Hours)**

Introduces students to biologics. The class of drugs referred to as biologics or biotherapeutics, proteins drugs, makes up a large portion of the drugs in development and on the market today. Focuses on considerations for approval for such drugs. Offers students an opportunity to learn how to be able to describe and explain both biologics and biosimilars.

**BIOT 5401. Scientific Communication and Problem Solving in Biotechnology. (3 Hours)**

Provides an in-depth examination of the principles and practices of scientific writing, academic integrity, literature analysis, and scientific problem solving. Focuses on effective communication of scientific ideas through various writing genres, including research articles, presentations, and proposals. Explores ethical considerations and best practices in scientific research, including issues related to plagiarism, data falsification, Good Documentation Practice (GDP), and authorship. Emphasizes critical skills in literature analysis and data presentation, including the evaluation and presentation of novel data sets and research articles and the effective integration of scientific literature into writing.

**BIOT 5500. Concepts in Regulatory Science. (3 Hours)**

Introduces the science that supports regulatory affairs in the biopharmaceutical industry. Focuses on the methods and instruments used to characterize the processes and products of biotechnology including the production, separation, purification, characterization, and formulation of biologics; the pharmacokinetics of proteins; chemical and biological equivalencies of biogenerics; stability testing; high throughput assays; cell system expression; variants; method validation; and quality control.

**BIOT 5560. Bioprocess Fundamentals. (3 Hours)**

Focuses on the fundamental principles and elements in the process of manufacturing biopharmaceuticals. Covers kinetics of enzymatic reactions; selected microbial and cell metabolism and relevant control mechanisms; kinetics of cell growth, cell death, substrate consumption, and product formation; mathematical modeling and representation of bioprocesses; examples of industrial bioprocesses to illustrate types and operations of upstream and downstream unit operations and mass transfers in fermentation systems—the affecting factors and the impact on process development and scale-up. Also includes an overview of economic considerations. Emphasizes bioprocesses for recombinant protein production.

**BIOT 5621. Protein Principles in Biotechnology. (3 Hours)**

Discusses the fundamentals in structural biology and biochemistry in drug design and applied biotechnology with special focus on protein chemistry. Explores the nature, structure, and function of proteins in the context of analytical analysis, molecular medicine, and drug discovery. Emphasizes bioinformatics and computational systems biology. Specifically investigates the analysis of ongoing research projects, case studies, and practical concepts of biotechnology.

**BIOT 5630. Cell Culture Applications for Biopharmaceuticals. (2 Hours)**

Covers principles and concepts in mammalian and other cell culture processes for biopharmaceutical manufacturing with the goal of providing a solid foundation in biopharmaceutical production. Topics include cell line development for protein expression; batch, fed-batch, and perfusion processes; media development; bioreactor operations; impeller designs; bioprocessing, including scale up and scale down; and advancements in cell culture techniques. Emphasizes quality assurance within a current good manufacturing practices environment and examines the entire bioprocessing workflow.

**BIOT 5635. Downstream Processes for Biopharmaceutical Production. (3 Hours)**

Addresses the development of recombinant protein purification processes in biotechnology. Provides an overview of the scientific principles, engineering strategies, and unit operations facilities involved in scalable protein purification processes. Also discusses viral clearance and inactivation strategies; cGMP considerations; and technological advances to improve effectiveness and efficiency, such as membrane-based disposable systems.

**BIOT 5640. Drug Product Processes for Biopharmaceuticals. (3 Hours)**

Introduces patient-focused drug product design for parenteral biopharmaceuticals. Explores the building of product knowledge through preformulation and formulation development, including lyophilization, to meet the target product profile for stability and during use. This expanding knowledge is applied to support of manufacturing processes and containers. Applies Quality-by-Design-based approaches to product development and discusses concepts related to Good Manufacturing Practice manufacturing. Culminates in a group project where teams address industrylike multifaceted problems bridging content from across the materials.

**Prerequisite(s):** BIOT 5621 with a minimum grade of C- or BIOT 5621 with a minimum grade of C- or CHEM 5620 with a minimum grade of C- or CHEM 5620 with a minimum grade of C-

**BIOT 5700. Molecular Interactions of Proteins in Biopharmaceutical Formulations. (3 Hours)**

Offers an up-to-date survey and review of the research and understanding of the molecular interactions of proteins in biopharmaceutical formulations, including both liquid and solid formats, during the process of drug product manufacturing. Focuses on protein-protein interactions, protein-excipients (e.g., stabilizers, surfactants) interactions, and protein at interface surfaces interactions that are critical and impactful on the stability and integrity of therapeutic proteins of interest. Emphasizes understanding the mechanistic aspect of the interactions; the approaches, methods, and techniques employed to study these phenomena; and measures considered to modulate such interactions to enhance the performance of the biopharmaceutical formulations. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** (BIOT 5621 with a minimum grade of C- or BIOT 5621 with a minimum grade of C-) or (CHEM 5620 with a minimum grade of C- or CHEM 5620 with a minimum grade of C- )

**BIOT 5750. Molecular Approaches in Biotechnology. (3 Hours)**

Discusses applications of concepts in molecular biology and biochemistry. Focuses on understanding the theory behind common techniques used in biotechnology. Topics include principles and methods for genetic manipulation, gene expression, nucleic acid sequencing, microarrays, and epigenomics. Emphasizes molecular signaling pathways, as well as primer and guide RNA design. Offers students an opportunity to practice proposal writing and other professional skills.

**BIOT 5800. Gene Therapies. (2 Hours)**

Provides an overview of specific gene therapy applications and diseases that are, or may be, a target of gene therapies. Includes case study analysis of gene therapies with publicly available information, as well as tools for proper identification of gene targets in disease states.

**BIOT 5810. Cutting-Edge Applications in Molecular Biotechnology. (3 Hours)**

Introduces the uses of molecular biology in a biotechnology setting. Includes a brief review of the basics and then dives into state-of-the-art molecular biology applications used in biotechnology today. These applications include stability and expression of cloned gene products, gene cloning strategies, transgenic species, mutation creation and analysis, DNA fingerprinting, PCR technology, microarray technology, gene probes, gene targeting, gene therapy, stem cell technology, antisense RNA, CAR T-cell therapy, RNA interference, and CRISPR/Cas9.

**BIOT 5820. Cellular Therapies. (2 Hours)**

The ever-changing landscape of the biotechnology field requires constant training. This course is designed to familiarize participants with some of the most cutting-edge topics available in molecular biology today: stem cells, RNA interference, CRISPR/CAS9, CAR T-cells, gene therapy, and more. Offers participants an opportunity to learn the theory behind these new technologies, how they are done, and their power in scientific discovery and treatment.

**BIOT 5830. Regulatory Landscape of Cell and Gene Therapies. (2 Hours)**

Introduces the current state of regulatory approvals for cell and gene therapies. Focuses on the scientific and technical considerations for approval for such drugs in the United States, in Europe, and in other key global markets. Explores the scientific challenges in the context of regulatory approval of these products, as well as how the process differs from traditional biotherapeutic product approvals. Examines how these regulatory pathways are evolving with a specific focus on quality, efficacy, and safety throughout the product life cycle (manufacturing through commercialization).

**BIOT 5840. Cell and Gene Therapy Lab. (3 Hours)**

Introduces selected key skills and techniques central to cell and gene therapy research. Combines hands-on training in cell and gene therapy skills with lecture and demonstration. Laboratory exercises highlight the current technical skills needed in the cell and gene therapy field, such as cell culture, siRNA, CRISPR/Cas9, stem cells, gene therapy, and editing, etc.

**Prerequisite(s):** BIOL 5821 (may be taken concurrently) with a minimum grade of C- or BIOL 5821 (may be taken concurrently) with a minimum grade of C- or BIOL 5821 (may be taken concurrently) with a minimum grade of C-

**BIOT 5850. Higher-Order Structure Analytics. (3 Hours)**

Offers a comprehensive look at various aspects of higher-order protein structures in biotherapeutics and their implications on biological drug design. Focuses heavily on protein aggregation, a type of HOS, and analysis of those aggregates including functional implications. Topics include a review of protein structure, protein aggregation, functional aspects, and techniques to reduce HOS using protein expression and purification strategies, protein folding in disease, macromolecular crystallography, nuclear magnetic resonance, analytical ultracentrifugation, circular dichroism, light scattering, electron spin labelling, cryo-EM, WAXS, and HDX-MS. Highlights experimental design and application to the biotechnology industry in identifying and reducing HOS.

**BIOT 5910. Vaccines and Immunization. (3 Hours)**

Emphasizes the importance of using vaccines in order to prevent the spread of infectious diseases and viruses. Discusses the evolution of vaccines throughout medical history (e.g., smallpox, polio), emphasizing lessons learned so they can be adapted to development of new and novel vaccines. Explains the molecular mechanism of how vaccines, such as vaccines that use attenuated virus to more novel vaccines that use mRNA, elicit an immune response. Examines the importance of immunization in the context of the immune system.

**BIOT 5920. Foundations in Vaccine Regulatory Science. (3 Hours)**

Explores the science behind how regulatory pathways were developed and how vaccines were approved for human use. The pathway for vaccine approvals by national regulatory authorities has been well established for decades. The SARS-CoV-2 pandemic created an immediate need to create new vaccines, which also created a new need for the regulatory approval of these vaccines. Examines how SARS-CoV-2 vaccines caused an increased interest in the regulatory science behind vaccine regulatory approval, specifically exploring the use of emergency use authorization (EUA) in getting SARS-CoV-2 vaccines to market. Discusses how the use of EUAs changed the regulatory science landscape of vaccines.

**BIOT 5930. Molecular Tools for Vaccine Design. (3 Hours)**

Discusses the molecular tools used for vaccine design and development, including the experimental tools used for attenuated whole-organism vaccines, purified macromolecule vaccines, and DNA or mRNA vaccines. Emphasizes vector design and development and specifically the challenges associated with vaccine design and development. Also studies computational tools that aid vaccine development.

**BIOT 5964. Projects for Professionals. (0 Hours)**

Offers students an applied project setting in which to apply their curricular learning. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review 'lessons learned,' and incorporate suggestions from this review to improve and further develop their career development and professional plan. May be repeated twice.

**BIOT 5976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

**BIOT 6100. Agricultural Biotechnology. (3 Hours)**

Explores the key agricultural biotechnology (agritech) principles and methods that are used in industry today; serves as a foundational course exposing students, briefly, to all aspects of agritech. Topics covered include gene transfer and genetic modification; cloning; plant biotechnology; animal science; food and ecological biotechnology; consumer concerns; safety testing; and other issues related to agritech.

**BIOT 6214. Experimental Design and Biostatistics. (2 Hours)**

Explores the principles of experimental design and statistical analysis. Emphasizes research in the molecular and biological sciences and biotechnology. Topics include probability theory, sampling hypothesis formulation and testing, and parametric and nonparametric statistical methods.

**BIOT 6290. Foundation in Quality for Biotechnology. (3 Hours)**

Presents concepts, tools, and techniques for real-world, on-the-job application of quality that is practical for a wide range of organizations. Offers an insight into the mindset of quality, along with an overview of the concepts, principles, processes, and activities involved in quality assurance, quality control, and regulatory compliance within the life sciences Industry. Emphasizes understanding the business of biotech; the remit of global regulatory agencies; principles and processes for establishing and enforcing regulation and guidance; quality management systems, operations, and compliance; quality leadership; quality planning; and careers in the quality profession. Includes presentations from a variety of industry experts.

**BIOT 6300. Pharmaceutical Microbiology. (3 Hours)**

Studies those microorganisms associated with the manufacture of pharmaceuticals, including biopharmaceuticals. Focuses on how to exclude microorganisms, such as exotoxins and endotoxins, from pharmaceutical processes to produce a sterile product. Considers how products react to microorganism contamination and methods of disinfection. Discusses pharmaceutical microbiology as related to clean rooms and controlled environments and methods and specifications related to microorganisms based on the United States Pharmacopeia guidelines. Lastly, discusses facility monitoring, specifically EM/critical utility testing, process monitoring, and maintenance throughout with an emphasis on what regulators expect to see in terms of data.

**BIOT 6310. CGMP Statutes and Regulation. (3 Hours)**

Focuses on the laws and regulations related to pharmaceuticals manufacture and administration. Discusses an overview of laws and regulations and provides guidance in the context of why they exist, their evolution, and implementation. Specifically focuses on the laws and regulations around good manufacturing practices (GMP), postapproval safety concerns, regulation of manufacture, violations and enforcement, and what to expect during an inspection from a regulatory body. Surveys the laws and regulations on a global level focusing on specific examples related to the United States, Europe, Asia, and other regulatory agencies.

**BIOT 6320. Design and Development of Biopharmaceuticals. (3 Hours)**

Focuses on the production and processes related to the design and development of pharmaceuticals, especially biopharmaceuticals. Discusses the implementation of a quality management system plan including document processes, procedures, metrics, reporting, and responsibilities aligned with pharmaceutical and biotechnology companies' business objectives. Emphasizes signaling problems (continual improvement plans), transparency, validation, and team cooperation/dynamics. Topics may include data management, product quality, and quality instruments. Specifically discusses the International Council for Harmonisation Q10 guidelines.

**BIOT 6340. Sterile Manufacturing Operations. (3 Hours)**

Discusses the importance of sterile operations in producing drug products, as part of good manufacturing practice (GMP). Emphasizes sterile manufacturing operations for all drugs.

**BIOT 6500. Professional Development for Co-op. (1 Hour)**

Introduces the cooperative education program. Offers students an opportunity to develop job-search and career-management skills; to assess their workplace skills, interests, and values and to discuss how they impact personal career choices; to prepare a professional resumé; and to learn proper interviewing techniques. Explores career paths, choices, professional behaviors, work culture, and career decision making.

**BIOT 6600. Agents of Bioterrorism. (3 Hours)**

Examines the probable weapons of biowarfare—including biological, chemical, and nuclear weapons—from several perspectives. Offers fundamental information on the biology and mechanism of action of the most important potential agents of terror and an introduction to the role of government. Topics include biological impact, detection and recognition, epidemiology, and treatment. Evaluates potential dangers and effectiveness and investigates strategies for defense against attacks by such weapons. Discusses the bioethical challenges of anti-bioterror research. Also offers students an opportunity to develop skills in scientific literacy and writing.

**BIOT 6610. Biosecurity and Bioterrorism. (3 Hours)**

Examines the national and international political, legal, and policy dimensions of response to threats of bioterrorism and resurging epidemics. Explores how the interagency community works at local, tribal, state, national, and international levels to meet these growing challenges. Resurging epidemics are now gaining national attention in a way not seen for generations. These threats join the long-standing challenges of potential domestic and foreign state-sponsored biowarfare attacks and the growing awareness of the threat of bioterrorism.

**BIOT 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**BIOT 6955. Co-op Work Experience Abroad - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**BIOT 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BIOT 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**BIOT 6965. Co-op Work Experience Abroad. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated without limit.

**BIOT 6980. Biotechnology Capstone. (2 Hours)**

Offers students an opportunity to integrate and apply the skills learned in earlier courses to an independent project supervised by a faculty mentor. The goals of the capstone are to develop skills in communicating the results of independent projects; increase student awareness of research in biotechnology outside of their own work; demonstrate a familiarity with the literature background to their work, including a working knowledge of literature searching; and provide an opportunity to reflect on individual progress toward a career in biotechnology.

**BIOT 7001. Managing Innovation in Biotechnology. (3 Hours)**

Offers students an opportunity to apply their curricular learnings in an applied project setting. Working with a project sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Course topics include the biotechnology innovation process, the assessment of market opportunities, the development of business models and risk management. Emphasizes development of professional skills, effective teamwork, and managing projects that involve uncertainty.

**Prerequisite(s):** (BIOT 5219 with a minimum grade of C- or BIOT 5219 with a minimum grade of C- or BIOT 5219 with a minimum grade of C- ); BIOT 6500 with a minimum grade of C-

**BIOT 7245. Biotechnology Applications Laboratory. (3 Hours)**

Presents a laboratory course in biotechnology with a focus on cutting-edge instrumentation that is currently used in the field. Directs special attention at the practical aspects of laboratory work in this field, for example, techniques in sample preparation, procedures for protein analysis, and new bioinformatic approaches. Focuses on the emerging field of chemiproteomics, which is the study of the interaction of small molecules with the proteome, that is, the full complement of proteins expressed in an individual cell or organism. Exposes the student to hands-on experience with modern instrumentation, such as mass spectrometry and high performance liquid chromatography.

**Prerequisite(s):** (BIOT 5145 with a minimum grade of C- or BIOT 5145 with a minimum grade of C- or BIOT 5145 with a minimum grade of C- ) or Biotechnology Lab Skills with a score of 80

**BIOT 7246. Molecular Technologies Practicum. (3 Hours)**

Introduces regional core facilities and covers specialized, state-of-the-art biotechnology techniques. Laboratory modules are taught on-site at—and in collaboration with—industry partner organizations. Students practice essential laboratory techniques while also studying research organizations within the biotechnology ecosystem (e.g., industry, research institutes). Combines hands-on training in advanced molecular technologies and applications of in vivo and in vitro models with lecture, demonstration, and data analysis. Offers students an opportunity to examine and practice skills in bioinformatics and techniques in recombinant DNA technology and to build foundational skills in experimental and disease models.

**Prerequisite(s):** (BIOT 5145 with a minimum grade of C- or BIOT 5145 with a minimum grade of C- or BIOT 5145 with a minimum grade of C- ) or Biotechnology Lab Skills with a score of 80

**BIOT 7247. Advanced Molecular Techniques in Microbial and Gene Expression Analysis. (3 Hours)**

Presents a comprehensive molecular technique for bacterial, yeast, and plant identification as well as gene expression studies and cloning methods. Emphasizes 16S rRNA and ITS region analysis, DNA sequencing, and phylogenetic analysis to classify microorganisms. Offers opportunity for students to develop skills in quantitative real-time PCR (rt-qPCR) for gene expression. Provides hands-on experience with cloning, transformant selection, and enzyme activity assays. Offers opportunities to analyze rt-qPCR data. Emphasizes critical analysis and problem solving in experimental workflows. Combines theoretical principles with practical applications and offers students the opportunity to develop advanced skills in molecular biology and biotechnology.

**Prerequisite(s):** BIOT 7246 with a minimum grade of C-

**BIOT 7983. Special Topics in Biotechnology. (1-4 Hours)**

Presents selected topics of current importance in biotechnology. May be repeated five times for a maximum of 6 total semester hours.

**Biotechnology - CPS (BTC)****BTC 1300. Introduction to Biotechnology. (3 Hours)**

Introduces the integrated science of genomics, proteomics, and bioinformatics using a case study, hands-on, problem-solving approach. Offers students an opportunity to practice accessing and using online databases to engage in real-time discoveries using the same approach current scientists use in their own research. Focuses on the process of doing genomic analysis and thinking from a genomics perspective. Uses integrated multimedia and web resources to introduce new technologies and to allow students to research and analyze real genomics data.

**Prerequisite(s):** BIO 1200 with a minimum grade of D- ; BIO 1201 with a minimum grade of D-

**Corequisite(s):** BTC 1301

**BTC 1301. Lab for BTC 1300. (1 Hour)**

Accompanies BTC 1300. Designed to introduce cutting-edge skills and techniques used in research labs and biopharmaceutical companies. Offers students an opportunity to learn the theoretical background of a technique in the lecture portion of the course and to be able to practice the techniques in the lab—to learn to read and write protocols; to accurately and precisely measure liquids and solids; to prepare solutions and media; to keep a virtual lab notebook, all while working in a safe and aseptic lab setting; and to learn how to perform electrophoresis, protein quantification, DNA extraction, and the basic use of a bioreactor.

**Prerequisite(s):** BIO 1200 with a minimum grade of D- ; BIO 1201 with a minimum grade of D-

**Corequisite(s):** BTC 1300

**BTC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BTC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BTC 3210. Immunology. (4 Hours)**

Provides an overview of the structure and function of genes, proteins, and cells involved in the generation of the immune response. Emphasizes molecular immunology and immunogenetics.

**Prerequisite(s):** BIO 1100 with a minimum grade of D- ; BIO 1101 with a minimum grade of D- ; BIO 1200 with a minimum grade of D- ; BIO 1201 with a minimum grade of D-

**BTC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BTC 4200. Genomics, Proteomics, and Bioinformatics. (3 Hours)**

Presents a comprehensive overview on genomics, proteomics, and bioinformatics, emphasizing their practical importance and applications in biotechnology. Integrates artificial intelligence (AI) and machine learning (ML) tools with bioinformatics techniques to address present-day challenges in genomic and proteomic research. Emphasizes protein structure prediction, gene annotation, protein property prediction, and data mining of bioactive molecules. Offers hands-on experience. Offers students an opportunity to enhance students' skills in bioinformatics, data analysis, problem-solving, and communication.

**Prerequisite(s):** (ITC 1000 with a minimum grade of C- or ITC 2016 with a minimum grade of C- ); (BTC 1300 with a minimum grade of C- ; BTC 1301 with a minimum grade of C- )

**BTC 4300. Biotechnology and Pharmaceutical Processing. (3 Hours)**

Focuses on the fundamental principles and elements in the process of manufacturing biopharmaceuticals using current good manufacturing practices (CGMPs). Covers kinetics of enzymatic reactions; selected microbial and cell metabolism and relevant control mechanisms; kinetics of cell growth, cell death, substrate consumption, and product formation; mathematical modeling and representation of bioprocesses; and examples of industrial bioprocesses to illustrate types and operations of upstream and downstream unit operations and mass transfers in fermentation systems. Emphasizes bioprocesses for recombinant protein production. Explores in-depth selected methods, techniques, and instruments used in biotechnology.

**Prerequisite(s):** BTC 1300 with a minimum grade of D- ; BIO 2300 with a minimum grade of D-

**Corequisite(s):** BTC 4301

**BTC 4301. Lab for BTC 4300. (1 Hour)**

Accompanies BTC 4300. Offers students an opportunity to learn important technical and safety concepts relevant to biotechnology and pharmaceutical processing while gaining hands-on experiences in a modern laboratory. Employs upstream equipment (e.g., cell culture vessels and sonication device); covers downstream operations (e.g., centrifuge and chromatography columns) and analytical tools (e.g., sensors, spectrophotometer, gel electrophoresis) for studying cell metabolism; recovering and separating cell components (e.g., organelles, DNA, proteins); purifying the target product (e.g., recombinant green fluorescent protein); and analyzing the efficacy of process steps through mass balancing.

**Prerequisite(s):** BTC 1301 with a minimum grade of D ; BIO 2300 with a minimum grade of D

**Corequisite(s):** BTC 4300

**BTC 4450. Quality Control and Validation Issues. (3 Hours)**

Introduces the regulations and guidelines affecting the development, production, registration, and sale of medical devices, diagnostics, pharmaceuticals, and biotechnology products worldwide. Focuses on why regulations are necessary, ethical considerations, and international standards. Offers practical instruction in the basics of quality control and process/facility validation for the biotechnology industry. Reviews appropriate regulations, including personnel and process flow, environmental and water testing, sterility testing, and incoming material and in-process testing. Other topics include the establishment of a master validation plan; description of facility, equipment, and process validations; and cleaning validations.

**Prerequisite(s):** BTC 1300 with a minimum grade of D- ; (MTH 2300 with a minimum grade of D- or MTH 2310 with a minimum grade of D- or MTH 3300 with a minimum grade of D- )

**BTC 4850. Biotechnology Senior Project. (3 Hours)**

Focuses on an in-depth project in which a student conducts research or produces a product related to the student's major field.

**Prerequisite(s):** BIO 2300 with a minimum grade of D- ; BIO 2500 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**BTC 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**BTC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BTC 5210. Human Experimentation: Methodological Issues Fundamentals. (3 Hours)**

Explores issues related to human experimentation, including scientific, technical, and methodological issues and the ethical, clinical, and financial repercussions of clinical trial studies. Covers how effective study designs can mitigate the common limitations and problems of clinical trials. Considers ethical issues, such as selective reporting of clinical research, informed consent, and protection of research participants in domestic and international clinical trials. Offers students an opportunity to develop and study statistical modeling and methodologies utilized in constructing clinical study designs.

**BTC 6210. Human Experimentation: Methodological Issues Fundamentals. (4 Hours)**

Explores issues related to human experimentation, including scientific, technical, and methodological issues and the ethical, clinical, and financial repercussions of clinical trial studies. Covers how effective study designs can mitigate the common limitations and problems of clinical trials. Considers ethical issues, such as selective reporting of clinical research, informed consent, and protection of research participants in domestic and international clinical trials. Offers students an opportunity to develop and study statistical modeling and methodologies utilized in constructing clinical study designs.

**BTC 6211. Validation and Auditing of Clinical Trial Information. (4 Hours)**

Presents a comprehensive overview of the management of quality assurance in clinical trials, Good Clinical Practices (GCP), and management of audit outcomes, as well as current issues and trends in the validation and auditing of clinical studies.

**Prerequisite(s):** BTC 6210 with a minimum grade of C- ; (RGA 6000 with a minimum grade of C- or RGA 6001 with a minimum grade of C- )

**BTC 6213. Clinical Trial Design Optimization and Problem Solving. (4 Hours)**

Discusses quantitative data analysis in creating dynamic drug-disease models, strategic market models, trial simulation models, and integrated financial models, which enable key variable analysis in clinical trial developments in real time. This integrated approach allows all decisions in the design to optimize value against both scientific and business criteria simultaneously and continuously. Offers students an opportunity to learn to take a complete view of the development process at the outset—across time, across the portfolio, and at all levels in the organization. This allows for greater insight into a drug's potential early in the process and leads to a more focused program for promising compounds, including an optimized clinical trial design. It also allows for earlier cessation of unpromising clinical trials, saving time and funds.

**Prerequisite(s):** (BTC 6210 with a minimum grade of C- ; RGA 6000 with a minimum grade of C- ) or RGA 6001 with a minimum grade of C-

**BTC 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Business Administration (BUSN)

**BUSN 1101. Applied Business Fundamentals. (4 Hours)**

Blends theoretical principles with real-life application. Introduces the fundamentals of launching, growing, and managing a business venture in today's dynamic and increasingly global environment. Examines concepts within multiple academic disciplines and from multiple perspectives—including marketing, technology, finance, accounting, information systems, people, and culture—and then applies them to new ventures within varied types of organizations. Offers students an opportunity to develop an entrepreneurial skill set and mind-set through the development of the critical thinking, innovative decision making, problem solving, and team building needed for any business, large or small.

**Attribute(s):** NUpath Difference/Diversity

**BUSN 1102. Personal Skill Development for Business. (1 Hour)**

Offers first-year students in the D'Amore-McKim School of Business (DMSB) an opportunity to achieve a better understanding of themselves as students and as future professionals. Explores self-analysis, leadership traits and styles, diversity and cultural awareness, professionalism, emotional intelligence, and ethics. Encourages students to draw connections among classroom education, extracurricular activities, and practical experiences and to identify how each component fits into the pursuit of their individual goals.

**BUSN 1103. Professional Development for Business Co-op. (1 Hour)**

Introduces students to the Cooperative Education Program and provides them with an opportunity to develop job-search and career-management skills. Offers students an opportunity to perform assessments of their workplace skills, interests, and values and discuss how they impact personal career choices. Students also have an opportunity to prepare a professional-style résumé, learn proper interviewing techniques, and gain an understanding of the opportunities available to them for co-op. Introduces career paths, choices, professional behaviors, work culture, and career decision making. Familiarizes students with workplace issues relative to their field of study and teaches them to use myNEU in the job-search and referral process. Presents co-op policies, procedures, and expectations of the Department of Cooperative Education and co-op employers.

**BUSN 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BUSN 2963. Topics. (1,2 Hours)**

Offers undergraduate students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering. May be repeated three times.

**BUSN 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BUSN 2992. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**BUSN 3110. The Consulting Environment. (4 Hours)**

Seeks to provide students with a framework and the fundamentals that allow them to understand the field of consulting in addition to a way of thinking for jobs in the consulting and other highly competitive careers. Focuses on the analysis of complex business situations using caselets and cases and provides frameworks as the basis for analysis and critical thinking in pressure situations. In addition, various articles, white papers, business case studies, and other consulting practices are shared with the students enrolled in the course as well as professionals with industry experience providing insights as visiting guest speakers.

**BUSN 3501. Impact of AI on Business. (4 Hours)**

Examines the impact of artificial intelligence on the core pillars of business—finance, sales, marketing, operations, engineering, and entrepreneurship. Offers students an opportunity to obtain a holistic understanding of how AI is reshaping these critical business domains and fostering the next wave of innovation. Discusses new business models, changes in go-to-market strategies for businesses, and the impact of AI-driven predictive analytics on finance. Explores new business possibilities enabled by AI and new approaches for using AI to complete traditional business activities.

**Prerequisite(s):** FINA 2201 with a minimum grade of D- or INNO 2301 (may be taken concurrently) with a minimum grade of D- or MKTG 2201 with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World

**BUSN 3944. Junior/Senior Internship. (1 Hour)**

Offers students an opportunity for internship work. May be repeated up to two times.

**BUSN 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BUSN 4945. In-the-Field Experiential Professional Practicum. (8 Hours)**

Offers students an opportunity, within a structured framework, to integrate academic learning with professional practice through a semester-long internship (16–20 hours per week) paired with a professional development course. Students partner with real-world organizations in their general field of study, applying existing and developing new academic knowledge to address practical challenges. Faculty mentorship and peer cohort discussions support reflection, professional skill development, adaptive problem solving, goal setting and monitoring, and communication skills. Students deliver tangible project outcomes to partner organizations and communicate their impact, learning, and professional growth through course deliverables, developing transferable skills and preparing for academic and career success.

**Attribute(s):** NUpath Integration Experience

**BUSN 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BUSN 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of faculty members of the department on a chosen topic. Course content depends on instructor. May be repeated up to three times for a maximum of 8 semester hours.

**BUSN 4998. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**BUSN 5963. Topics. (1,2 Hours)**

Offers students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering. May be repeated three times.

**BUSN 5964. Projects for Professionals. (0 Hours)**

Offers students an applied project setting in which to apply their curricular learning. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review 'lessons learned' and incorporate suggestions from this review to improve and further develop their career development and professional plan.

**BUSN 5965. Engaging with Industry Partners for Rising Professionals. (0 Hours)**

Offers students an enhanced applied project setting in which to apply their curricular learning. Working with a partner sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with the partner sponsor, and create a plan for implementing their recommendations. Curriculum supports students as they develop key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review lessons learned, and incorporate suggestions to improve and further hone their career development and professional plan. Career development opportunities through skill-building workshops, panels, and interview preparation are available. Partner-student interactions, including a culminating project presentation, allow partners to assess student potential for co-op, internship, or other employment opportunities with the partner. May be repeated two times.

**BUSN 6200. Career Management. (0 Hours)**

Required for the Co-op MBA program. Begins with an introduction to the career planning process and to the services of the MBA Career Center. Topics include résumé writing, videotaped practice interviewing, job search strategies, interview preparation, salary negotiation, marketing communication, and visa issues for international students seeking employment in the United States. May include additional topics depending on student interest. Requires admission to co-op MBA program. May be repeated once.

**BUSN 6203. Strategic Sustainability. (1 Hour)**

Introduces tools and frameworks for analyzing a firm's sustainability and facilitating its strategic sustainability transformation. Examines what strategic sustainability is and why it is important; the drivers of strategic sustainability; measurement of strategic sustainability; and implementation of environmental, social, and governance strategic sustainability. Studies the three dimensions (environmental, social, and governance) of strategic sustainability and the use of concepts and frameworks for assessing strategic sustainability. Offers students an opportunity to analyze and provide recommendations on how to implement a firm's strategic sustainability.

**BUSN 6296. Introduction to Data Storytelling and Visualization for Business. (1 Hour)**

Studies the skills required to effectively tell stories with data to drive business decisions. Covers data analysis, interpretation, and visualization techniques. Emphasizes understanding audience perspectives and mastering business presentation techniques. Offers students an opportunity to cultivate the ability to communicate complex data findings in a simple, concise, and influential manner to both technical and nontechnical audiences, thereby fostering data-driven decision making.

**BUSN 6297. Leading Business Transformation. (1 Hour)**

Studies the mindset, skill set, and tool set needed to make relevant changes in the way businesses and organizations operate. Examines the four dimensions of business changes: work processes, organization structure, digital transformation, and cultural transformation. Focuses on leading and driving business value. Applies to any level and business function.

**BUSN 6298. Supply Chain Impact on Reaching Net Zero. (1 Hour)**

Introduces the global supply chain ecosystem, as well as the scope and impact of supply chain on the net zero goals. Defines the hurdles to change including customer choice, technology limitations, and investment. Discusses solutions required to create the massive improvement necessary to meet targets and explore sourcing objectives, total cost analysis, supplier innovation, and risk-mitigation topics.

**BUSN 6299. Building Profitable and Sustainable Online Experiences. (1 Hour)**

Offers a rigorous introduction to the craft of using data, behavioral science, and machine learning to create highly personalized and engaging app experiences that make users happy. Focuses on free-to-play apps and presents case studies covering personalization systems with proven lift in engagement, retention, and monetization.

**BUSN 6324. Predictive Analytics for Managers. (1 Hour)**

Presents the concepts of correlation and simple linear regression analysis as well as multiple regression analysis. Offers students an opportunity to build multiple regression models and use them in forecasting and analyzing data. Exposes students to nonlinear regression models, reading and analyzing output tables, and using statistical software tools.

**BUSN 6329. Generative AI and Large Language Models in Finance. (1 Hour)**

Explores the essentials of generative AI and large language models (LLMs), with a focus on their applications, risks, and limitations in finance. Includes practical, hands-on exercises and industry case studies. Covers prompt engineering best practices, designing LLM processing pipelines, and building knowledge retrieval systems.

**BUSN 6343. Sharing Economy, Crowdsourcing, and Digital Business Transformation. (1 Hour)**

Explores how a highly connected world driven by technological advances fuels a digital transformation centered around networks, crowds, and markets. Covers network effects and 'rich-get-richer' phenomena; business models and strategies for multisided markets and platforms; crowdsourcing and online labor markets; sharing economy; and new ways organizations become innovative by tapping into expertise outside firms' boundaries. Discusses business cases from industries including Uber/Lyft, Airbnb, Kickstarter, Amazon's Mechanical Turk, Upwork, Etsy, eBay, InnoCentive, and TopCoder. Explicitly addresses possible negative consequences. Explores critical risks such as bias and inequality due to deregulation, social and algorithm-based discrimination, and an overall critique of growth-based business models. Offers students an opportunity to hone their skills to spearhead game-changing digital initiatives to learn how to manage others in the wake of disruptive changes.

**BUSN 6344. The Fintech Revolution. (1 Hour)**

Uses case studies and illustrations to explore the key major innovations that are revolutionizing and driving opportunities in fintech. Topics may include payments: payment processing, transfers, rewards; blockchain: digital currency, smart contracts, DLT, trading; investments: Robo Advisors, investment management; planning: retirement planning, education planning; lending: crowdfunding, P-2-P lending, alternative money-raising platforms; insurance: underwriting, comparison platforms; big data and analytics: AI and big data solutions, alternative data; security: cybersecurity, authentication, encryption. Also discusses business models and opportunities in fintech, including the evolution of fintech and the current state of the art; case studies of successful business models in fintech startups; key things that differentiate a successful fintech company; and best practices and tips when working on a fintech idea.

**BUSN 6351. Experiential Education. (1-3 Hours)**

Consists of various experiential learning opportunities that are approved by the faculty of the D'Amore-McKim School of Business for full-time MBA students. May be repeated five times for a maximum of six semester hours.

**BUSN 6355. Current Developments in the ESG Landscape. (1 Hour)**

Presents an overview of current developments in ESG (environmental, social, and governance) issues. Focuses on case studies analyzing how organizations are addressing ESG-related challenges. Offers multiple perspectives including the challenges faced by business leaders, the role of investor action, how civil society can shape the landscape, and the effects of recent regulatory changes.

**BUSN 6356. Growth Strategies Enabled by Technology. (1 Hour)**

Exploration into the intersection of strategy, marketing, and technology with a focus on product led growth. Examines the opportunities and challenges digitally native businesses experience in growth acceleration and monetization. Focuses on product-led growth within the intersection of strategy, marketing, and technology.

**BUSN 6357. Introduction to Social Enablement. (1 Hour)**

Introduces social enablement, a structured approach to networking using today's social platforms. Uses a mix of live, hands-on activities and asynchronous learning exercises to offer participants an opportunity to use social media effectively to build professional relationships and enhance their online visibility.

**BUSN 6363. Social Impact of Business. (2 Hours)**

Explores how business practices affect society and how society affects business practices. Addresses topics such as social impact investing, sustainable supply chains, corporate social responsibility, social entrepreneurship, and global perspectives on corporate citizenship. Business and society have never been more intertwined. Executives are increasingly called upon to consider the larger societal impacts of their decisions and at the same time find themselves subject to demands from multiple societal stakeholders that include customers, suppliers, employees, governments, and interest groups, among others.

**BUSN 6365. Business Analytics. (3 Hours)**

Provides an overview of data collection, organization, analysis, interpretation, and presentation techniques used by contemporary organizations. Students use multiple software tools to collect, prepare, manage, analyze, evaluate, understand, critique, visualize, and present data sets of various types. Offers students an opportunity to obtain essential skills, tools, and techniques required to understand data sets, both large and small, from sources internal and external to an organization. This understanding can then be used to support datacentric decision making and create a measurable improvement in business performance. Businesses run on data, and employees at all levels must know how to properly use and interpret data to support their roles within a company.

**BUSN 6366. International Corporate Governance and Strategic Thinking. (1 Hour)**

Introduces key concepts in strategic corporate governance. Offers students an opportunity to use these concepts to understand the different economic, social, and political contexts across advanced industrial and emerging economies. Describes key aspects of corporate governance systems in a number of different countries and analyzes the strengths and weaknesses of these systems in comparison. Examines the importance of social and political factors in shaping different models of firm organization across countries and how new governance practices and institutional norms develop in response to changes in the real world of business management.

**BUSN 6375. Designing 21st-Century Business Organizations. (1 Hour)**

Addresses the question: What is the most effective organizational design (or designs) for meeting the challenges of the 21st century? Describes a process for designing an organization, along with some of the key challenges associated with organizational design. Reviews the design options available historically, as well as designs that are more popular in recent years. Asks students to justify their own conclusions about which organizational design is best suited to meet the requirements and challenges facing business organizations today.

**BUSN 6376. The Business Case for Social and Economic Justice. (1 Hour)**

Examines how strategic business decisions are made and governing policies established in today's changing corporate environment. Discusses whether it is advisable for CEOs to "take a stand" on behalf of their company and their employees when fundamental shared values and a company's purpose or mission are at stake. After a grounding in business governance theory and history, students debate whether CEOs should speak openly on controversial public issues. One can make the case that a CEO taking a position on one side of a public issue is a significant strategic risk. Conversely, stakeholders are increasingly demanding that business leaders publicly take positions and change business practices to align with those values.

**BUSN 6377. Learning from Crisis:Toward Sustainability and Resilience. (1 Hour)**

Highlights the importance of public-private sector interconnections and systemic partnerships within communities to promote resilience and enable progress toward sustainable development, such as those promoted by the United Nations Sustainable Development Goals (UN SDGs). Covers the nexus between resilience, sustainable development, and the impact of crises on societies and multinational corporations. Includes both conceptual material and examples. Includes a case study competition where students are presented with a challenge scenario and then asked to provide a presentation where they think creatively about how firms and communities can have a reciprocal relationship toward sustainable development and resilience.

**BUSN 6379. Entrepreneurial Ecosystems. (1 Hour)**

Examines the development, growth strategies, and stewardship of entrepreneurial ecosystems and "startup communities." Defines and measures ecosystems. Studies the ways that governments, corporations, and community groups attempt to shape ecosystem development. Surveys leading authorities in the field and looks at real-world examples of success and partial success from several different perspectives.

**BUSN 6382. Real Options. (1 Hour)**

Introduces the concept of real options, offers theoretical underpinnings for the method, and broadly covers option pricing methods. Examines the use of real options in making financial decisions for capital budgeting decisions, helping to maximize shareholder value. Explores methods such as net present value, or NPV, and internal rate of return, or IRR, to evaluate the feasibility of projects. Examines several applications in project valuation using MS Excel.

**BUSN 6383. Blockchain and Decentralized Finance. (1 Hour)**

Introduces the fundamental building blocks of blockchain technology, as well as its application in cryptocurrencies and, in particular, decentralized finance. Covers the fundamentals of cryptography, such as hash functions and digital signatures. Emphasizes three major DeFi applications: stablecoins, lending platforms, and exchanges.

**BUSN 6384. Marketing in the Metaverse. (1 Hour)**

Explores how firms are using metaverses for marketing purposes to enhance marketing strategy and to create value for customers in virtual worlds through marketing experiences similar to what a brand does in real life. Examines current trends, drivers, and barriers to the use of metaverses for marketing purposes. Studies how a metaverse can help in marketing activities—marketing strategy, advertising, and customer relationships—and how established firms have started engaging in marketing in a metaverse—Nike launching "Nikeland," a metaverse game where people can interact with the brand.

**BUSN 6385. Introduction to Product Management. (1 Hour)**

Introduces core product management principles with a primary focus on technology products in consumer (B2C) and enterprise (B2B) companies. Studies core concepts and frameworks that offer participants an opportunity to readily apply structures to a variety of product development problems. Frameworks include business and product strategy building, prioritization and operational planning, execution and reporting, go-to-market, and sales and customer success. Uses case studies of some of the most widely used products in the world at large tech companies and emerging products from the startup world where product-market fit is yet to be achieved. Covers current trends in AI-assisted product development.

**BUSN 6386. Crafting Your Personal Strategy. (1 Hour)**

Examines the application of strategy frameworks and practices for crafting individual professional strategies. Applies concepts of mindfulness and strategic thinking to formulate strategic actions to create a pathway toward personal vision within a professional world. Offers students an opportunity to define and identify their personal vision, match their vision to external and internal environments, and formulate their personal strategy for a market entry.

**BUSN 6387. Job Is Easy, People Are Not. (1 Hour)**

Explores the complex challenges of becoming leaders and managing people. Studies 10 essential smart (not soft) skills that are vital for personal and professional development. Fosters insight in how to develop and apply these skills in various aspects of life, how to self-correct, and how to help others adjust their behaviors to become better professionals.

**BUSN 6389. Leading Global Virtual Innovation Teams. (1 Hour)**

Examines what it means to lead a global virtual team as well as to learn how to develop and practice their unique leadership approaches to remote collective work. Addresses a series of unprecedented challenges of leading a virtual team and introduces and practices the solutions for challenges based on leading-edge scientific research and well-tested industrial practices. Adopts extensive experiential learning approaches in conjunction with the case study method to help students understand the core concepts and competencies that transform students' virtual leadership capabilities.

**BUSN 6390. Overview of Blockchain, Cryptocurrencies, NFTs, and Decentralized Finance. (1 Hour)**

Presents an overview of blockchain technology; cryptocurrencies; nonfungible tokens; and decentralized finance, or DeFi. Explores the fundamentals of blockchain technology including its history, underlying principles, and use cases. Covers various cryptocurrencies, such as bitcoin and ethereum, and their functions, such as digital transactions, smart contracts, and tokenization. Delves into the world of NFTs including their creation, ownership, and marketplaces. Concludes with an overview of DeFi and its impact on traditional finance, lending and borrowing, and decentralized exchanges.

**BUSN 6393. Managing Individual and Collective Well-Being in Organizations. (1 Hour)**

Offers students an opportunity to diagnose well-being bottlenecks in organizations and devise relevant solutions to support satisfying careers, effective leadership, and talent retention. Introduces different aspects of well-being and work/nonwork integration in contemporary organizations. Exposes students to tools used to implement initiatives at the individual, team, and organizational levels that align with strategic goals and organizational culture.

**BUSN 6402. Stakeholder Values and Societal Challenges in Business. (2 Hours)**

Examines how to analyze the impact that societal challenges have in business decision making. Focuses on the challenges that companies face when embracing and empowering goals to add value to their shareholders and stakeholders while "doing good." Examines the increasingly complex relations between businesses with outsized power and reach and governments in developed and emerging economies. Studies the implications of firm-level and government-level decision making and the impact on the specific communities where decisions are enacted. Studies the roles played by for-profit entities, not-for-profit entities, nongovernmental organizations, and government agencies in exploring, understanding, and achieving progress with these challenges.

**BUSN 6945. Washington Campus Seminar. (3 Hours)**

Offers a weeklong educational residency in Washington, D.C., where students meet with members of Congress, current and former executive branch officials, senior civil servants, business executives, lobbyists, representatives of the media, and special-interest groups. Offers students an opportunity to understand how Washington works, how legislative and regulatory changes impact their business futures, and what new business opportunities may evolve as the result of federal policy priorities and decisions. The residency seeks to offer unparalleled insight into the process of government, with the goal of enabling top business leaders to contribute ethically and effectively to the policy debate, influence policy outcomes, and leverage their understanding of policy trends to developing new business opportunities.

**BUSN 6950. MBA Skills Workshop. (0 Hours)**

Continues the full-time MBA orientation program. Offers students an opportunity to develop the management skills necessary to become effective managers, including communication skills, qualitative and quantitative business analysis, and ethics and values.

**BUSN 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**BUSN 6955. Co-op Work Experience Abroad - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**BUSN 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**BUSN 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated up to five times.

**BUSN 6965. Co-op Work Experience Abroad. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated twice.

**BUSN 6970. Professional Projects. (0 Hours)**

Offers graduate students an opportunity to participate in flexible, professional work experiences through micro-internships, an alternative to a traditional corporate residency or co-op. Students demonstrate and enhance their career readiness competencies, explore career paths, and expand their network. These project-centered experiences are primarily remote, involve 10 to 40 hours of work, and are deadline driven as opposed to set during specific hours. May be repeated five times.

**BUSN 6976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of faculty members of the department on a chosen topic. Course content depends on instructor. May be repeated up to four times.

**BUSN 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

## Cardiopulmonary and Exercise Science (EXSC)

**EXSC 1120. Introduction to Exercise, Fitness, and Health. (4 Hours)**

Explores the fundamental role of exercise and fitness in health. Introduces principles of exercise and various components of fitness and wellness. Discusses the development of basic exercise prescription for cardiorespiratory endurance, muscular strength, and endurance and flexibility and provides hands-on experiences of measuring these components. Includes discussions on a wide range of topics, including advances and innovations in health and fitness and practices that lead to more healthful living.

**EXSC 2991. Research in Exercise Science. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated once.

**EXSC 4500. Exercise Physiology 1. (4 Hours)**

Introduces exercise physiology. Covers the muscular, neuromuscular, cardiovascular, ventilatory, endocrine, and metabolic responses to acute exercise and the physiological adaptations to chronic exercise and physical activity. Basic concepts related to physical fitness, body composition, weight control, and training principles are discussed.

**EXSC 4501. Lab for EXSC 4500. (1 Hour)**

Accompanies EXSC 4500. Offers experiments in the exercise physiology laboratory that introduce concepts related to the lecture content of the course and include techniques such as strength testing, ergometry, graded exercise testing, indirect calorimetry, and body composition assessment.

**EXSC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EXSC 5200. Cardiopulmonary Physiology. (3 Hours)**

Offers students an opportunity to gain an understanding of physiological principles of the cardiopulmonary system. Covers the structure and functional operation and regulation of the cardiopulmonary system, disease-associated physiological changes and cardiopulmonary dysfunction, and exercise-induced acute responses and physiological adaptations of the system and their applications to chronic cardiopulmonary diseases. Integrates knowledge of exercise and physical activity with cardiopulmonary health and fitness, as well as cardiopulmonary disease prevention and treatment.

**Prerequisite(s):** ((BIOL 2217 with a minimum grade of C- ; BIOL 2219 with a minimum grade of C- ) or EXSC 4500 with a minimum grade of C- ) or graduate program admission

**EXSC 5210. Physical Activity and Exercise: Prescription, Measurement, and Testing. (3 Hours)**

Studies the general principles of physical activity and exercise prescription, measurement, and testing. Offers students an opportunity to learn the fundamental concepts and techniques to measure physical activity, exercise, and related testing procedures through a hands-on approach. Topics include the use of questionnaires and activity monitors to measure physical activity; measurement of body composition, fitness, muscular strength, and endurance; and clinical exercise testing. The fundamental concepts of exercise prescription and use of measurement techniques taught in this course are applicable to careers in physical therapy, exercise physiology, and as a physician assistant. Requires prior completion of EXSC 4500 or equivalent undergraduate course or permission of instructor.

**EXSC 5220. Advanced Exercise Physiology. (3 Hours)**

Covers the advanced study of concepts, principles, and research in the field of exercise physiology. Discusses advanced concepts in the muscular/neuromuscular, cardiovascular, ventilatory, endocrine, and metabolic responses to exercise and exercise training. Specific study of the physiological control mechanisms regulating these systems are also addressed during periods of rest, acute exercise, and following chronic exercise training.

**Prerequisite(s):** EXSC 4500 with a minimum grade of D- or graduate program admission

**EXSC 5230. Physical Activity and Exercise: Effects on Musculoskeletal Health and Disease. (3 Hours)**

Seeks to provide a foundation for understanding the benefits of physical activity and exercise and the detrimental effects of physical inactivity and sedentary behavior on musculoskeletal health. Studies the function/dysfunction of the musculoskeletal systems resulting in common/uncommon disorders and the prevalence, etiology, and benefits of physical activity/exercise. Students apply previously learned exercise physiology principles, such as exercise prescription and neural and motor control adaptations, to physical activity and exercise. Discusses key physiological mechanisms underlying common/uncommon musculoskeletal disorders. Examines the preventive and beneficial effects of physical activity and exercise endorsed by the American College of Sports Medicine. Restricted to graduate students in exercise science and to undergraduate students minoring in exercise science.

**Prerequisite(s):** EXSC 4500 with a minimum grade of D- or graduate program admission

**EXSC 5240. Clinical Nutrition Applications in Health and Disease. (3,4 Hours)**

Prepares health professionals to effectively communicate principles of diet and nutrition to their clients and the public. Covers public health promotion strategies, techniques used to teach diet and nutrition, and behavioral theories used in diet and nutrition intervention. Emphasizes clinical applications for the treatment of weight disorders, diabetes, cardiovascular disease, eating disorders, and nutrition in the life cycle.

**EXSC 5976. Directed Study. (1-4 Hours)**

Offers independent course work under the direction of members of the department on chosen topics. Requires submission of a written proposal to the program adviser prior to the intended semester. May be repeated without limit.

**EXSC 6202. Electrocardiography, Clinical Assessment, and Prescription. (3 Hours)**

Focuses on the identification and management of chronic diseases. Offers students an opportunity to learn skills to interpret EKGs. Topics include cardiac electrophysiology, lead systems, dysrhythmia recognition and treatment, axis, infarction, ischemia, hypertrophy, and the effects of cardiovascular drugs and exercise on the EKG. Through case studies, students interpret exercise test results, prescribe exercise, and evaluate exercise programs for clinical conditions such as cardiovascular disease, pulmonary conditions, and metabolic diseases.

**EXSC 6300. Internship in Exercise Science. (3 Hours)**

Offers students an opportunity to obtain practical experience and to synthesize, integrate, and apply skills and knowledge learned in the exercise science curriculum in a professional environment. Field experiences are an important part of graduate education programs in exercise science. The student is expected to complete a minimum of 300 hours of supervised experience in a research or practice setting. May be repeated once.

**Prerequisite(s):** (EXSC 5200 with a minimum grade of D- or EXSC 5200 with a minimum grade of C- (Graduate)); (EXSC 5210 with a minimum grade of D- or EXSC 5210 with a minimum grade of C- (Graduate)); (EXSC 5220 with a minimum grade of D- or EXSC 5220 with a minimum grade of C- (Graduate))

**EXSC 6400. Applied Research Methods. (3 Hours)**

Studies how to conduct scientific research in exercise science. Offers students an opportunity to propose a research project and design appropriate methodology to complete the project. Includes discussions on developing research hypotheses, comparing study designs, selecting appropriate statistical analyses, and managing data collection. Incorporates interpretation of published research to support the proposed research. Students present their own research plans through scientific writing.

**EXSC 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EXSC 6966. Practicum. (1-4 Hours)**

Provides eligible students with an opportunity for practical experience. May be repeated four times.

**EXSC 7991. Thesis 2. (3 Hours)**

Continues EXSC 7990.

**Prerequisite(s):** EXSC 7990 with a minimum grade of C-

**Chemical Engineering (CHME)****CHME 1983. Special Topics in Chemical Engineering. (1-4 Hours)**

Focuses on topics related to chemical engineering to be selected by instructor. May be repeated up to nine times.

**CHME 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHME 2204. History of Fluid Mechanics. (4 Hours)**

Traces the development of fluid mechanics from its antiquity to the present. Considers and emphasizes the impact of various cultures to contributions in the field, including Egyptian, Greek, Chinese, Arabic, and modern European cultures. Covers fluid properties, measurements, and equipment through the discoveries and applications of these cultures. Follows the role of fluid mechanics in modernizing the world through contributions by Archimedes, da Vinci, Newton, Bernoulli, Prandtl, and others.

**CHME 2308. Conservation Principles in Chemical Engineering. (4 Hours)**

Examines the applications of fundamental laws of mass and energy conservation to chemical and physical processes. Emphasizes material and energy balances on chemical processes. Offers students an opportunity to develop skills in applying chemistry, physics, and mathematics to identify and solve chemical engineering problems.

**Prerequisite(s):** CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1211 with a minimum grade of D-

**CHME 2310. Transport Processes 1. (4 Hours)**

Covers the fundamentals of transport of incompressible and compressible fluids (fluid flow) along with energy transport. Concepts are continued in CHME 3312 with emphasis on heat transport. The methods taught are relevant to the analysis of engineering processes in a number of industries, including chemical, pharmaceutical, food, energy, biotechnology, and materials.

**Prerequisite(s):** MATH 2321 with a minimum grade of D- ; CHME 2308 with a minimum grade of D- ; MATH 2341 (may be taken concurrently) with a minimum grade of D-

**CHME 2320. Engineering Thermodynamics. (4 Hours)**

Covers the first and second laws of thermodynamics and their application to batch and flow systems, heat effects in chemicals, and physical properties/real fluids. Applies basic principles and mathematical relations to the analysis and solution of engineering problems.

**Prerequisite(s):** CHME 2308 with a minimum grade of D- ; MATH 2321 with a minimum grade of D-

**CHME 2322. Engineering Thermodynamics Abroad. (4 Hours)**

Covers the first and second laws of thermodynamics and their application to batch and flow systems, heat effects in chemicals, and physical properties/real fluids. Applies basic principles and mathematical relations to the analysis and solution of engineering problems. Taught abroad.

**Prerequisite(s):** MATH 2321 with a minimum grade of D- ; CHME 2308 with a minimum grade of D-

**CHME 2983. Special Topics in Chemical Engineering. (1-4 Hours)**

Focuses on topics related to chemical engineering to be selected by instructor. May be repeated up to nine times.

**CHME 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHME 2991. Research in Chemical Engineering. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated four times.

**CHME 2992. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors. May be repeated up to nine times.

**CHME 3305. Chemical Engineering Laboratory. (4 Hours)**

Offers students an opportunity to obtain hands-on laboratory experience and to develop safety, teamwork, problem-solving, organizational, technical writing, and oral presentation skills. Focuses on the discovery of fundamental momentum, heat, and mass transport principles. Those fundamentals are used to develop and design engineering solutions through experiments in the context of the current fields of chemical engineering. Emphasizes the hazards associated with these chemical engineering experiments and the materials handled during laboratory.

**Prerequisite(s):** CHME 2310 with a minimum grade of D- ; (CHME 2320 with a minimum grade of D- or CHME 2322 with a minimum grade of D- ); (ENGW 3302 (may be taken concurrently) with a minimum grade of D- or ENGW 3315 (may be taken concurrently) with a minimum grade of D- )

**Corequisite(s):** CHME 3306

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Writing Intensive

**CHME 3306. Recitation for CHME 3305. (0 Hours)**

Accompanies CHME 3305. Discusses laboratory safety, experimental design and design of experiments (DOE), data analysis, data presentation, and report-writing strategies.

**Corequisite(s):** CHME 3305

**CHME 3312. Transport Processes 2. (4 Hours)**

Continues CHME 2310. Presents the fundamentals and applications of energy transport, mass transport, and simultaneous energy/mass transport. The methods taught are relevant to the analysis of engineering processes in a number of industries, including chemical, pharmaceutical, food, energy, biotechnology, and materials.

**Prerequisite(s):** CHME 2310 with a minimum grade of D- ; MATH 2341 with a minimum grade of D-

**CHME 3315. Chemical Engineering Experimental Design 1. (4 Hours)**

Offers students an opportunity to obtain hands-on laboratory experience and to develop safety, teamwork, problem-solving, organizational, technical writing, and oral presentation skills. Focuses on fundamental momentum transport principles and skills to develop and design engineering solutions through experiments in the context of the current fields of chemical engineering. Emphasizes the hazards associated with those chemical engineering experiments.

**Prerequisite(s):** CHME 2310 with a minimum grade of D- ; (ENGW 3302 (may be taken concurrently) with a minimum grade of D- or ENGW 3315 (may be taken concurrently) with a minimum grade of D- )

**Corequisite(s):** CHME 3316

**Attribute(s):** NUpath Analyzing/Using Data

**CHME 3316. Recitation for CHME 3315. (0 Hours)**

Accompanies CHME 3315. Presents discussions related to laboratory safety, experimental design, data analysis, data presentation, and report writing strategies.

**Corequisite(s):** CHME 3315

**CHME 3322. Chemical Thermodynamics. (4 Hours)**

Covers thermodynamic properties of mixtures; fugacity and the fugacity coefficients from equations of state for gaseous mixtures; liquid phase fugacities and activity coefficients for liquid mixtures; phase equilibria; the equilibrium constant for homogeneous gas-phase reactions; and extension of theory to handle simultaneous, heterogeneous, and solution reactions.

**Prerequisite(s):** CHME 2320 with a minimum grade of D- or CHME 2322 with a minimum grade of D-

**CHME 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHME 4315. Chemical Engineering Experimental Design 2. (4 Hours)**

Offers students an opportunity to obtain hands-on laboratory experience and to develop safety, teamwork, problem-solving, organizational, technical writing, and oral presentation skills. Focuses on the discovery of fundamental heat and mass transport principles. Those fundamentals are used to develop and design engineering solutions through experiments in the context of the current fields of chemical engineering. Focuses on the hazards associated with these chemical engineering experiments and the materials handled during laboratory.

**Prerequisite(s):** (CHME 3312 (may be taken concurrently) with a minimum grade of D- ; (CHME 3315 with a minimum grade of D- or CS 2510 with a minimum grade of D- )); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1101 with a minimum grade of C or ENGW 1111 with a minimum grade of C )

**Corequisite(s):** CHME 4316

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Writing Intensive

**CHME 4316. Recitation for CHME 4315. (0 Hours)**

Accompanies CHME 4315. Presents discussions related to laboratory safety, experimental design, data analysis, data presentation, and report writing strategies.

**Corequisite(s):** CHME 4315

**CHME 4510. Chemical Engineering Kinetics. (4 Hours)**

Covers fundamental theories of the rate of chemical change in homogeneous reacting systems, integral and differential analysis of kinetic data; design of batch and continuous-flow chemical reactors; and an introduction to heterogeneous reactions and reactor design.

**Prerequisite(s):** CHME 3312 with a minimum grade of D- ; CHME 3322 with a minimum grade of D-

**CHME 4512. Chemical Engineering Process Control. (4 Hours)**

Covers Laplace transform and its use in solving ordinary differential equations; modeling liquid-level, temperature, and composition dynamics; linearization of nonlinear systems; first- and second-order system transfer functions; and PID control; computer simulation of open- and closed-loop systems; control system stability; and feed-forward and cascade control.

**Prerequisite(s):** CHME 3312 with a minimum grade of D- ; CHME 3322 with a minimum grade of D-

**CHME 4625. Chemical Process Safety Abroad. (4 Hours)**

Introduces important technical fundamentals as applied to chemical process safety internationally. Demonstrates good chemical process safety practice through chemical plant visits, visiting experts, and video presentations in the international setting in which the course is offered.

**Prerequisite(s):** CHME 2320 (may be taken concurrently) with a minimum grade of D- or CHME 2322 (may be taken concurrently) with a minimum grade of D-

**CHME 4626. Special Topics in Process Safety Abroad. (4 Hours)**

Covers special topics unique to the host country as related to chemical process safety. Includes chemical plant visits, review of specialized testing methods used in process safety, as well as national and international compliance requirements.

**Prerequisite(s):** CHME 2322 (may be taken concurrently) with a minimum grade of D- or CHME 2320 (may be taken concurrently) with a minimum grade of D-

**CHME 4701. Separations and Process Analysis. (4 Hours)**

Focuses on the design of a chemical process with a particular emphasis on separation technologies. Topics include computer simulation of steady-state processing conditions, selecting process operations, reactor design, preparing flow sheets and stream tables, and evaluating the economics of a chemical process design.

**Prerequisite(s):** CHME 3312 with a minimum grade of D- ; CHME 3322 with a minimum grade of D- ; CHME 4510 (may be taken concurrently) with a minimum grade of D-

**CHME 4703. Chemical Process Design Capstone. (4 Hours)**

Offers students an opportunity to participate in an open-ended, project-based design course where teams design innovative solutions of a comprehensive chemical process. Considers public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. Students apply engineering knowledge from their undergraduate academic studies to design a chemical process that handles mass and energy balances. Requires proof of concept data from prototypes, experiments, or simulations of the process to show the design is feasible and that use of the data improves the design. Team presentations, in multiple formats, are shared with the chemical engineering community for feedback and evaluation. Requires multiple progress reports, submitted by the team, which results in the final design report at the end of the semester.

**Prerequisite(s):** (CHME 3305 with a minimum grade of D- or CHME 4315 with a minimum grade of D- ); CHME 4701 with a minimum grade of D- ; (CHME 4512 (may be taken concurrently) with a minimum grade of D- or PHYS 3600 (may be taken concurrently) with a minimum grade of D- )

**Corequisite(s):** CHME 4705

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov, NUpath Writing Intensive

**CHME 4705. Recitation for CHME 4703. (0 Hours)**

Accompanies CHME 4703. Provides a common meeting platform for all students in individual sections of CHME 4703 to meet on a weekly basis. Guest speakers and common lectures will be delivered during this recitation.

**Corequisite(s):** CHME 4703

**CHME 4983. Special Topics in Chemical Engineering. (1-4 Hours)**

Focuses on topics related to chemical engineering to be selected by instructor. Topics vary by semester. May be repeated up to three times for a maximum of 16 semester hours.

**CHME 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHME 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated up to two times.

**Prerequisite(s):** CHME 3305 with a minimum grade of D-

**Attribute(s):** NUpath Integration Experience

**CHME 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**Prerequisite(s):** CHME 2311 with a minimum grade of D-

**CHME 5100. Applied Mathematics for Chemical Engineers. (4 Hours)**

Focuses on the practical application of math skills to solve problems in chemical engineering. Introduces relevant concepts and techniques from calculus, differential equations, linear algebra, and statistics. Provides a foundation for graduate-level coursework in chemical engineering.

**CHME 5101. Fundamentals of Chemical Engineering: Fluid, Heat, and Mass Transfer. (4 Hours)**

Designed for students transitioning into chemical engineering or returning to academics, this course examines some of the fundamental principles of the discipline. Topics include vector and tensor calculus, continuum mechanics and thermodynamics, macroscopic and microscopic analyses of mass, momentum, and energy conservation, and how they are transported. Focuses on applying and solving mathematical formulations of the underlying equations.

**Prerequisite(s):** MATH 2341 with a minimum grade of D- or graduate program admission

**CHME 5102. Fundamentals of Chemical Engineering: Thermodynamics and Kinetics. (4 Hours)**

Designed for students transitioning into chemical engineering or returning to academics, this course examines some of the fundamental principles of the discipline. Topics include macroscopic and microscopic mass analyses, the First and Second Laws of Thermodynamics, phase and chemical reaction equilibrium, chemical reaction kinetics, and reactor design. Focuses on applying and solving mathematical formulations of the underlying equations.

**Prerequisite(s):** MATH 2341 with a minimum grade of D- or graduate program admission

**CHME 5105. Materials Characterization Techniques. (4 Hours)**

Covers the fundamentals and applications of materials characterization techniques. Major techniques include electron microscopy imaging, microbeam analysis, diffraction techniques, and near-field scanning probe techniques. Offers students an opportunity to learn transmission electron microscopy, scanning electronmicroscopy, electron and X-ray beam analysis, scanning tunneling microscopy, atomic force microscopy, and scanning near-field optical microscopy. Covers the applications of these techniques on both solid-state materials, such as metal and ceramics, and soft materials and biomaterials, such as polymers and nanostructured materials. Incorporates lab sessions on scanning electron microscopy and microanalysis.

**CHME 5137. Computational Modeling in Chemical Engineering. (4 Hours)**

Builds on chemical engineering fundamentals to introduce computer programming to allow simulation of physical, chemical, and biological systems. Covers numerical experiments (e.g., Monte Carlo, global sensitivity analysis) to analyze the significance of parameters and model assumptions. Offers students an opportunity to work on a research or design project throughout the course.

**Prerequisite(s):** (CHME 3312 with a minimum grade of D- ; CHME 3322 with a minimum grade of D-) or graduate program admission

**CHME 5160. Drug Delivery: Engineering Analysis. (4 Hours)**

Focuses on engineering analysis of drug delivery systems, demonstrating the application of classic engineering principles to a nontraditional field for chemical engineers. Presents quantitative analysis of transport of a drug through the body and its control by physical and chemical drug and drug delivery device properties. Emphasizes the influence of biological tissue composition and structure on these processes.

**CHME 5179. Complex Fluids and Everyday Materials. (4 Hours)**

Introduces intra- and intermolecular forces and moves on to material deformation in response to external stress, including polymeric elasticity. Covers topics in colloidal science and biological physics: the microscopic origins of suspension stability and biological self-assembly. Additional topics include "molecular gastronomy," personal care and cleaning products, active materials, and experimental techniques. Studies of complex fluids and soft materials are highly interdisciplinary. Many everyday materials are combinations of the three phases of matter—solid, liquid, and gas—with unique material properties. "Complex fluids" and "soft matter" refer to suspensions, emulsions, foams, and gels, which include personal care items, household cleaners, and even food. Nearly all biological material can be described as a soft material.

**CHME 5185. Design of Experiments and Ethical Research (DOEER). (4 Hours)**

Designed to provide a comprehensive approach to introducing interdisciplinary biochemical engineering research and design of experiments. Through immersion in a collaborative classroom, offers students an opportunity to develop the thought processes, skills, and strategies required for originating and performing high-impact research that broadens scientific knowledge. Emphasizes design of experiments, statistics, and considerations in conducting ethical research. Topics include case studies in conflict of interest, bioethics, laboratory safety, scientific misconduct, authorship and publication, literature and peer review, data visualization and integrity, statistical analysis, and contemporary issues. Students complete online and training modules in laboratory safety and apply their knowledge as they study applications for experiments, including power analysis and rigor, to design scientific aims with peer review. Meets NIH for RCR.

**CHME 5510. Fundamentals in Process Safety Engineering. (4 Hours)**

Introduces the basic concepts in process safety engineering as applied to the process industries as well as various terms and lexicon. Reviews the fundamentals involved in the prediction of scenarios and covers the assumptions involved as well as the range of these predictions. Emphasizes toxicology, industrial hygiene, sources models, toxic releases, and dispersion models, as well as fire and explosion prevention.

**CHME 5515. Process Safety Engineering for Biotechnology and Pharmaceutical Industries. (4 Hours)**

Examines process safety engineering considerations for the biotechnology and pharmaceutical industries. Considers clean-in-place methods, the handling of flammables within the production area, the keeping of material in pipes and vessels, basic ventilation requirements, how to handle flammable and reactive chemicals, the process safety involved in spray dryers, and how to assess hazards by hazard analysis techniques.

**CHME 5520. Designing for Process Safety. (4 Hours)**

Explores computational models for identifying and mitigating hazardous conditions in industrial operations. Focuses on understanding fire and explosion risks, emphasizing safety and sustainability. Covers the application of predictive modeling tools to design safer industrial processes.

**CHME 5621. Electrochemical Engineering. (4 Hours)**

Introduces fundamental concepts of electrochemical thermodynamics, kinetics, and mass transport and places them in context for applications such as batteries, fuel cells, and electrochemical sensors. Additional topics include porous electrode theory, cyclic voltammetry, Pourbaix diagrams, and the structure of the electrochemical double layer.

**Prerequisite(s):** (MATH 2321 with a minimum grade of C- ; MATH 2341 with a minimum grade of C- ) or graduate program admission

**CHME 5630. Biochemical Engineering. (4 Hours)**

Focuses on topics relevant to the design of cell culture processes for the production of pharmaceuticals. Topics include an overview of prokaryotic vs. eukaryotic cells; enzyme kinetics; overview of cellular processes (DNA replication, transcription, translation, primary metabolism, and regulation of protein synthesis at the transcriptional, posttranslational, and metabolic levels); overview of genetic engineering methods (for bacteria, mammalian, and plant cells); kinetics of cell growth (growth models, growth kinetic parameters); kinetics of product formation; bioreactor design and optimum operating conditions; scale-up; and overview of product recovery and purification methods.

**Prerequisite(s):** CHME 3312 with a minimum grade of D- or (BIOE 3310 with a minimum grade of D- ; BIOE 3380 with a minimum grade of D- ) or graduate program admission

**CHME 5631. Biomaterials Principles and Applications. (4 Hours)**

Offers a broad overview of the field of biomaterials (materials used in medical devices that interact with living tissues). Begins with introductory lectures on biomaterials and their translation from the laboratory to the medical marketplace and progresses to discussions of important biomaterials terminology and concepts. Basic materials science lectures then emphasize material structure-property-function-testing relationships. Concludes with introductions to topics in the field such as biomaterials-tissue interactions, tissue engineering, regulatory requirements, etc. Considers principles of device design as related to the selection and application of biomaterials throughout this course.

**CHME 5632. Advanced Topics in Biomaterials. (4 Hours)**

Addresses several important topics in biomaterials, specifically, materials used in medical devices that communicate with living tissues. Topics that may be addressed include biomaterials: past, present, and future; tissue engineering: scope, status, promise, challenges; biomaterials-tissue interactions; regulated medical device design, fabrication, and testing; strategies for translating medical products from concept to the marketplace; and medical device disasters. Some topics are covered in more depth than others depending on their value and interest to the students.

**CHME 5642. Photochemistry Fundamentals and Applications. (3 Hours)**

Describes fundamental science of light-activated chemistry and photochemistry applications. Topics include organic and inorganic photochemistry and their applications in solar energy, solar fuels, photocatalysis, bioimaging, photochemotherapy, pigments, and photonics.

**Prerequisite(s):** (CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- ) or graduate program admission

**CHME 5643. Photochemistry Lab. (1 Hour)**

Offers the opportunity to conduct a photochemistry experiment using electronic absorption spectroscopy.

**Prerequisite(s):** (CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- ) or graduate program admission

**CHME 5649. Numerical Strategies and Data Analytics for Chemical Sciences. (4 Hours)**

Introduces a broad range of numerical methods for solving large-scale, data-driven problems that arise in chemical engineering, chemistry, biochemistry, and other chemical sciences. Offers students an opportunity to obtain a detailed understanding of the derivation, analysis, and use of these numerical methods and learn how these lay the foundations to machine learning techniques. Topics include numerical programming logic, linear and nonlinear algebraic equations, polynomial fitting, numerical calculus, optimization techniques, and large-scale data analysis. Applies to a broad field of chemical and biochemical sciences, where large-scale multivariate data analyses and pattern extraction are key components.

**Prerequisite(s):** ((MATH 1341 with a minimum grade of D- ; MATH 1342 with a minimum grade of D- ) or (MATH 2321 with a minimum grade of D- ; MATH 2341 with a minimum grade of D- )) or graduate program admission

**CHME 5683. Introduction to Polymer Science. (4 Hours)**

Introduces basic concepts of polymers and polymer properties. Covers macromolecular structure from both theoretical and experimental viewpoints, polymerization processes and kinetics, polymer/solvent thermodynamics, crosslinking and network dynamics, thermal and phase behavior of polymers, viscoelasticity and mechanical behavior, diffusion in polymers, and selected advanced topics. Designed for both undergraduate and graduate students. No prior knowledge of polymers is required.

**CHME 5692. Carbon Capture, Utilization, and Storage. (4 Hours)**

Discusses diverse technological approaches for carbon capture, utilization, and storage, or CCUS. Lectures cover legislative, economic, and societal considerations of realizing CCUS on a large scale. Offers students an opportunity to gain a comprehensive understanding of climate change and decarbonization problems. Students work on a miniproject on the conceptual design and evaluation of a decarbonization approach (of their choice), which can include, e.g., well-established carbon capture technologies, emerging electrochemical or biological methods, industrial energy efficiency, mineralization, carbon dioxide capture in oceans, or reforestation studies. This course is designed to help develop a solid foundation to embark on a career in a sustainability-related business or research institution.

**CHME 5699. Special Topics in Chemical Engineering. (1-4 Hours)**

Explores specialized topics in chemical engineering, selected by the instructor. May be repeated up to eleven times for a maximum of 12 semester hours.

**CHME 5976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated up to three times for a maximum of 4 total semester hours.

**CHME 5984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**CHME 6310. Python for Chemical Engineers. (2 Hours)**

Introduces chemical engineers to the Python programming language and how it can be applied to solve disciplinary problems, including those from material and energy balances, thermodynamics, transport, and kinetics. Covers linear algebra, calculus, differential equations, working with datasets, data visualization, and regression.

**CHME 6320. Numerical and Statistical Methods for Chemical Engineering. (4 Hours)**

Focuses on the numerical and statistical mathematical methods often utilized by chemical engineers for solving problems and working with data. Includes methods to solve linear, non-linear, and sets of linear ordinary differential equations; solve partial differential equations; create graphs of data and apply appropriate statistical tests; and perform curve regression and evaluate fit. Introduces advanced mathematical techniques including vector calculus, Monte Carlo simulations, optimization methods, and machine learning.

**CHME 6390. Professional Development and Communication Essentials. (0 Hours)**

Explores topics related to building advanced careers in chemical engineering. Focuses on strategies for academic success, communication, and networking. Offers students an opportunity to build a sense of cohort community and to learn about ongoing research projects in the Department of Chemical Engineering, professional workplace behaviors, and ethical conduct in a research environment.

**CHME 6410. Chemical Engineering Research Methods. (2 Hours)**

Introduces research skills required to perform research in chemical engineering. Covers topics related to research skill development, such as literature search, research ethics, design of experiments, data processing, graph making, scientific critical analysis and effective scientific communication, both written and oral.

**CHME 6420. Engineering for Chemical Sustainability. (2 Hours)**

Discusses the rationale and approaches for integrating sustainability into the design of chemical products and processes. Emphasizes technical and design practice and measuring the impacts of products and processes in business, environmental, and social contexts. Introduces students to methods used in green chemical engineering, particularly as applied to reaction engineering, management of the nitrogen and carbon cycles, and decarbonization.

**CHME 6430. Chemical Engineering for Biosystems and Biomaterials. (2 Hours)**

Applies chemical engineering principles to biosystems and biomaterials, including biomedical and biological systems. Foundations of chemical engineering, including transport phenomena, thermodynamics, and kinetics, are discussed in the context of bio-phenomena.

**CHME 6580. Artificial Intelligence for Process Engineering Capstone. (4 Hours)**

Offers students an opportunity to apply artificial intelligence (AI) and machine learning (ML) principles to a real-world process engineering problem. Emphasizes model development, data interpretation, and practical implementation. Considers ethical implications of AI applications, including bias, transparency, and decision-making accountability. Project-based work incorporates simulations, experiments, and case studies and culminates in student final reports.

**Prerequisite(s):** CS 6140 with a minimum grade of C+ or EECE 5644 with a minimum grade of C+ or IE 7300 with a minimum grade of C+

**CHME 6610. Computational Programs in Process Safety for Relief and Scenario Modeling. (4 Hours)**

Focuses on the use of process safety software that is available to perform hazard analysis, relief and flare system evaluation, and scenario analysis. The software may include use of Process Safety Office (ioMosaic), Aspen Process Simulator (Aspen Technologies), and FLACS (Flame Acceleration Simulator by GexCon). These programs are dedicated to predicting relief sizing for vessels and processes; flare system sizing; chemical reactivity analysis; and dispersion modeling, should a release occur, and its damage potential either as an explosive or toxic cloud.

**CHME 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHME 7262. Special Topics in Process Safety. (4 Hours)**

Covers topics of interest to the staff member conducting this class for advanced study. Current topics relevant in process safety are considered, such as a focus on layers of protection analysis, qualitative risk analysis, and specific process safety challenges. Process safety challenges from industrial settings may also serve as problems tackled in the course. A student may not take more than one special topics course with any one instructor.

**CHME 7320. Chemical Engineering Mathematics. (4 Hours)**

Focuses on the formulation and solutions of problems involving advanced calculus as they arise in chemical engineering systems. Covers ordinary differential equations, series solutions, and complex variables. Also studies applications involving Laplace transforms, partial differential equations, matrix operations, vectors and tensors, and optimization methods. Emphasis is on methods for formulating the problems.

**Prerequisite(s):** (CHME 4510 with a minimum grade of C- or CHME 5101 with a minimum grade of B- or CHME 5101 with a minimum grade of B-) or graduate program admission

**CHME 7330. Chemical Engineering Thermodynamics. (4 Hours)**

Offers a graduate-level introduction to the fundamental principles relating molecular structure and bulk material properties. Begins with classical thermodynamics laws that govern macroscopic conservation, equilibrium stability, and irreversible processes, including open processes, multicomponent phase equilibrium, and reaction equilibrium. Introduces relationships between microscopic states and macroscopic properties, applied to understand systems such as non ideal fluids, crystalline solids, polymers, and electrolytes. Statistical thermodynamics concepts may also be applied through the use of analytical theory and computational molecular modeling.

**Prerequisite(s):** (CHME 3322 with a minimum grade of C- or CHME 5101 with a minimum grade of B- or CHME 5101 with a minimum grade of B-) or graduate program admission

**CHME 7340. Chemical Engineering Kinetics. (4 Hours)**

Covers fundamental theories of the rate of chemical change in homogeneous reacting systems, integral and differential analysis of kinetic data. Examines the theoretical foundations for the analysis of elementary chemical reaction rates. Comprises analysis and modeling of batch and ideal flow reactors, axial and radial dispersion in flow tubular reactors, and design principles of gas solid catalytic reactors. Builds on undergraduate chemical engineering kinetics concepts. Requires proficiency in calculus and differential equations.

**Prerequisite(s):** (CHME 4510 with a minimum grade of C- or CHME 5101 with a minimum grade of B- or CHME 5101 with a minimum grade of B-) or graduate program admission

**CHME 7350. Transport Phenomena. (4 Hours)**

Explores analytical and approximate solutions of equations of momentum, energy, and mass transport and their analogies. Covers heat and mass transfer at a fluid-solid interface. Introduces creeping, potential, and boundary layer flows. Examines macroscopic balances for isothermal systems and interphase transport of multicomponent systems.

**Prerequisite(s):** (CHME 3312 with a minimum grade of C- or CHME 5101 with a minimum grade of B- or CHME 5101 with a minimum grade of B-) or graduate program admission

**CHME 7390. Seminar. (0 Hours)**

Presents topics of an advanced nature by staff, outside speakers, and students in the graduate program. All seminars by outside speakers must be attended by all full-time graduate students; all other seminars must be attended when required by the instructor. May be repeated without limit.

**CHME 7391. Professional Development and Communication in Chemical Engineering 1. (1 Hour)**

Focuses on communication and integrates tightly with the graduate seminar series (CHME 7390). Offers students an opportunity to learn how to articulate scientific accomplishments to the scientific community, write high-quality manuscript outlines, develop proposals for graduate fellowships, give high-quality short and long seminar presentations, and critique and peer-review research manuscripts and proposals. Students also have an opportunity to learn about ongoing research projects in the Department of Chemical Engineering, professional workplace behaviors, and ethical conduct in a research environment. This is the first of four required courses (CHME 7392, 7393, and 7394).

**CHME 7392. Professional Development and Communication in Chemical Engineering 2. (1 Hour)**

Focuses on communication and integrates tightly with the graduate seminar series (CHME 7390). Offers students an opportunity to learn how to give high-quality short and long seminar presentations, write a high-quality research proposal, assemble all the components of a research proposal, and develop research strategies to realize their own research projects.

**CHME 7393. Professional Development and Communication in Chemical Engineering 3. (1 Hour)**

Focuses on communication and integrates tightly with the graduate seminar series (CHME 7390). Offers students an opportunity to write and submit high-quality graduate fellowship proposals, develop high-quality outlines of research proposals related to their dissertation proposal, critique and peer-review publications and proposals, and learn about the latest development in ongoing research in the Department of Chemical Engineering.

**CHME 7394. Professional Development and Communication in Chemical Engineering 4. (1 Hour)**

Focuses on communication and integrates tightly with the graduate seminar series (CHME 7390). All PhD students that have successfully completed their closed-door proposal defense give a 25-minute public podium presentation of their research. Students prepare a two-page detailed abstract and a presentation, attend and critique presentations given by their peers, and also submit the final version of a research or review article.

**CHME 7395. Mentoring in Chemical Engineering. (1 Hour)**

Offers graduate students an opportunity to connect theoretical concepts learned in the classroom to real-life innovations, identify the conceptual framework of existing technological innovations, identify the conceptual aspects of their own research activities, propose innovative strategies to connect them to real-life applications, and to learn the basics of mentoring to be able to transfer their knowledge and expertise to their peers or to undergraduate students. Students may attend workshops on effective teaching and mentoring and mentor undergraduate students under the supervision of experienced academic and/or industrial mentors.

**CHME 7600. Pharmaceutical Engineering I. (4 Hours)**

Introduces the fundamental principles of chemical engineering as applied to biopharmaceutical manufacturing. Emphasizes quantitative problem solving. Covers conservation principles (mass and energy balances), kinetics (enzyme kinetics and cell growth kinetics), and heat transfer (sterilization, reactor heat management). Focuses on bioprocess economics and upstream unit operations, principally bioreactor design. The application of computer programming and numerical methods to solve these problems is interwoven throughout the course. This is the first of a two-semester course series.

**CHME 7601. Pharmaceutical Engineering II. (4 Hours)**

Continues a two-semester course series to introduce the fundamental principles of chemical engineering as applied to biopharmaceutical manufacturing, with an emphasis on quantitative problem solving. Covers critical aspects of fluid flow (e.g., pipe/pump sizing, centrifugation); mass transfer (diafiltration, oxygen sparging, membrane fouling); and thermodynamics (partitioning of analytes in chromatography). Focuses on downstream separation unit operations within biopharmaceutical production. Applies computer programming and numerical methods to solve these problems.

**Prerequisite(s):** CHME 7600 with a minimum grade of C-

**CHME 7602. Pharmaceutical Engineering Laboratory. (2 Hours)**

Offers students an opportunity to apply and reinforce the theory they have learned in their pharmaceutical engineering coursework in a hands-on laboratory setting by producing and purifying a recombinant protein from cell culture. In a series of lab modules, teams of students set up, operate, and analyze bioreactors for bacterial and mammalian cell culture, as well as harvest and lyse cells, and finally purify and analyze protein using state-of-the-art filtration and chromatography processes. Requires submission of interim laboratory reports, documentation of experimental work, and a final report and presentation with a detailed proposal for how to improve upon the results obtained.

**Prerequisite(s):** CHME 7601 (may be taken concurrently) with a minimum grade of C-

**CHME 7901. Journal Club in Chemical Engineering. (1 Hour)**

Offers students an opportunity to critically read, interpret, and present published data; to discuss the strengths and weaknesses of publications; and to interpret and critically evaluate published scientific data in a student-led journal club that cover topics related to chemical engineering. May be repeated up to seven times for a maximum of 8 SH.

**CHME 7945. Master's Project. (4 Hours)**

Offers students an opportunity for individual effort consisting of laboratory and/or computational investigation, analysis of results, and preparation of a definitive report as part of an advanced research project in an area of chemical engineering determined by the student and their advisor.

**CHME 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHME 7973. Special Topics in Chemical Engineering. (1-4 Hours)**

Focuses on topics related to chemical engineering to be selected by the instructor. May be repeated up to seven times for a maximum of thirty two semester hours.

**CHME 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated up to three times for a maximum of 4 semester hours.

**CHME 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**CHME 7990. Thesis. (4 Hours)**

Offers analytical and/or experimental work conducted under the direction of the faculty in fulfillment of the requirements for the degree. First-year students must attend a graduate seminar program that introduces the students to the methods of choosing a research topic, conducting research, and preparing a thesis. Successful completion of the seminar program is required.

**Prerequisite(s):** CHME 7945 with a minimum grade of C-

**CHME 7996. Thesis Continuation - Half-Time. (0 Hours)**

Continues thesis work conducted under the supervision of a departmental faculty.

**CHME 8960. Candidacy Preparation—Doctoral. (0 Hours)**

Offers students an opportunity to prepare for the PhD qualifying exam under faculty supervision. Intended for students who have completed all required PhD course work and have not yet achieved PhD candidacy; students who have not completed all required PhD course work are not allowed to register for this course. May be repeated once.

**CHME 8984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**CHME 8986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**CHME 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of program requirements for PhD candidacy.

**CHME 9984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**CHME 9986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**CHME 9990. Dissertation Term 1. (0 Hours)**

Offers theoretical and experimental work conducted under the supervision of a departmental faculty.

**Prerequisite(s):** CHME 9000 with a minimum grade of S

**CHME 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** CHME 9990 with a minimum grade of S

**CHME 9996. Dissertation Continuation. (0 Hours)**

Continues thesis work conducted under the supervision of a departmental faculty. May be repeated up to eleven times.

**Prerequisite(s):** CHME 9990 with a minimum grade of S or Dissertation Check with a score of REQ

## Chemistry - CPS (CHM)

**CHM 1100. General Chemistry 1. (3 Hours)**

Introduces the principles of chemistry. Topics include basic principles and definitions, stoichiometry, chemical equilibrium, moles, gas laws, atomic structure, periodic relationships, and chemical bonding.

**Corequisite(s):** CHM 1101

**Attribute(s):** NUpath Natural/Designed World

**CHM 1101. Lab for CHM 1100. (1 Hour)**

Accompanies CHM 1100. Covers a range of topics from the course.

**Corequisite(s):** CHM 1100

**CHM 1200. General Chemistry 2. (3 Hours)**

Studies the principles of chemical equilibrium and the rates and mechanisms of chemical reactions. Covers solutions, chemical kinetics, chemical equilibria, chemical thermodynamics, and electrochemistry.

**Prerequisite(s):** CHM 1100 with a minimum grade of D- ; CHM 1101 with a minimum grade of D-

**Corequisite(s):** CHM 1201

**Attribute(s):** NUpath Natural/Designed World

**CHM 1201. Lab for CHM 1200. (1 Hour)**

Accompanies CHM 1200. Covers a range of topics from the course, such as measurements of heat transfer, rate and equilibrium constants, acid-base reactions, the properties and uses of buffer systems, and the effects of temperature and catalysts.

**Prerequisite(s):** CHM 1100 with a minimum grade of D- ; CHM 1101 with a minimum grade of D-

**Corequisite(s):** CHM 1200

**CHM 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHM 2110. Organic Chemistry 1. (3 Hours)**

Introduces nomenclature, synthesis, molecular structure and bonding, and reaction mechanisms. Includes chemistry of hydrocarbons and their functional derivatives, stereochemical relationships and nucleophilic substitutions, and elimination reactions.

**Prerequisite(s):** CHM 1200 with a minimum grade of D- ; CHM 1201 with a minimum grade of D-

**Corequisite(s):** CHM 2111

**CHM 2111. Lab for CHM 2110. (1 Hour)**

Accompanies CHM 2110. Introduces basic laboratory techniques, such as distillation, crystallization, extraction, chromatography, characterization by physical methods, and measurement of optical rotation, which serve as the foundation for the synthesis, purification, and characterization of products from microscale syntheses.

**Prerequisite(s):** CHM 1200 with a minimum grade of D- ; CHM 1201 with a minimum grade of D-

**Corequisite(s):** CHM 2110

**CHM 2200. Organic Chemistry 2. (3 Hours)**

Continues CHM 2110. Focuses on additional functional group chemistry, including alcohols, ethers, carbonyl compounds, amines, and the molecules of nature. Introduces spectroscopic methods for structural identification.

**Prerequisite(s):** CHM 2110 with a minimum grade of D- ; CHM 2111 with a minimum grade of D-

**Corequisite(s):** CHM 2201

**CHM 2201. Lab for CHM 2200. (1 Hour)**

Accompanies CHM 2200. Applies basic laboratory techniques from CHM 2111 to chemical reactions of alcohols, ethers, carbonyl compounds, carbohydrates, and amines. Introduces basic laboratory techniques and instruments for the structural analysis of organic molecules.

**Prerequisite(s):** CHM 2110 with a minimum grade of D- ; CHM 2111 with a minimum grade of D-

**Corequisite(s):** CHM 2200

**CHM 2300. Analytical Chemistry. (3 Hours)**

Introduces the principles and practices in the field of analytical chemistry. Focuses on development of a quantitative understanding of homogeneous and heterogeneous equilibria phenomena as applied to acid-base and complexometric titrations, rudimentary separations, optical spectroscopy, electrochemistry, and statistics.

**Prerequisite(s):** CHM 1200 with a minimum grade of D- ; CHM 1201 with a minimum grade of D-

**Corequisite(s):** CHM 2301

**Attribute(s):** NUpath Writing Intensive

**CHM 2301. Lab for CHM 2300. (1 Hour)**

Accompanies CHM 2300. Offers students an opportunity to obtain hands-on experience in lab experiments in analytical methods, such as silver chloride gravimetry, complexometric titrations, acid-base titrations, UV-Vis spectroscopy, cyclic voltammetry, Karl Fischer coulometry, and modern chromatography.

**Prerequisite(s):** CHM 1200 with a minimum grade of D- ; CHM 1201 with a minimum grade of D-

**Corequisite(s):** CHM 2300

**CHM 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHM 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHM 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHM 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Chemistry and Chemical Biology (CHEM)****CHEM 1000. Chemistry/Chemical Biology at Northeastern. (1 Hour)**

Intended for freshmen in the College of Science. Introduces students to liberal arts; familiarizes them with their major; develops the academic skills necessary to succeed (analytical ability and critical thinking); provides grounding in the culture and values of the University community; and helps to develop interpersonal skills—in short, familiarizes students with all skills needed to become a successful university student.

**CHEM 1101. General Chemistry for Health Sciences. (4 Hours)**

Provides a one-semester introduction to general chemistry for the health sciences. Covers the fundamentals of elements and atoms; ionic and molecular structure; chemical reactions and their stoichiometry, energetics, rates, and equilibria; and the properties of matter as gases, liquids, solids, and solutions. Other topics include acids and bases, and nuclear chemistry. Applications to the health sciences are included throughout.

**Corequisite(s):** CHEM 1102, CHEM 1103

**Attribute(s):** NUpath Natural/Designed World

**CHEM 1102. Lab for CHEM 1101. (1 Hour)**

Accompanies CHEM 1101. Covers a range of topics from the course, such as qualitative and quantitative analysis and the characteristics of chemical and physical processes. Includes measurements of heat transfer, rate and equilibrium constants, and the effects of temperature and catalysts. Emphasis is on aqueous acid-base reactions and the properties and uses of buffer systems.

**Corequisite(s):** CHEM 1101, CHEM 1103

**CHEM 1103. Recitation for CHEM 1101. (0 Hours)**

Accompanies CHEM 1101. Covers various topics from the course.

**Corequisite(s):** CHEM 1101, CHEM 1102

**CHEM 1117. Chemical Perspectives on Green Energy: Emerging Technologies and Opportunities. (4 Hours)**

Introduces the chemical principles behind everyday energy sources in the 21st century, including both classic and emergent sources. Examines critical questions concerning the demand for energy and the environmental impact of fuel consumption. Emphasizes the role that chemistry plays in the search for, and emergence of, renewable energy sources, such as biofuels, wind energy, and advanced battery technology. Offers students an opportunity to develop knowledge concerning evaluation of the efficiency of technologies and their impact on current global climate and to gain an appreciation of the sociopolitical debates surrounding traditional and emergent energy technologies. High school chemistry strongly recommended.

**Attribute(s):** NUpath Natural/Designed World

**CHEM 1151. General Chemistry for Engineers. (4 Hours)**

Corresponds to one semester of study in important areas of modern chemistry, such as details of the gaseous, liquid, and solid states of matter; intra- and intermolecular forces; and phase diagrams. Presents the energetics and spontaneity of chemical reactions in the context of chemical thermodynamics, while their extent and speed is discussed through topics in chemical equilibria and kinetics. Aspects of electrochemical energy storage and work are considered in relation to batteries, fuel, and electrolytic cells.

**Corequisite(s):** CHEM 1153

**Attribute(s):** NUpath Natural/Designed World

**CHEM 1153. Recitation for CHEM 1151. (0 Hours)**

Accompanies CHEM 1151. Offers a weekly sixty-five-minute drill/discussion session conducted by chemistry faculty or graduate teaching assistants. Discusses the homework assignments of CHEM 1151 in detail with emphasis on student participation.

**Corequisite(s):** CHEM 1151

**CHEM 1161. General Chemistry for Science Majors. (4 Hours)**

Introduces the principles of chemistry, focusing on the particulate nature of matter and its interactions and reactions that form the basis for the underlying molecular dynamics of living systems. Presents basic concepts of chemical bonding and intermolecular interactions for molecules and molecules' behavior in aqueous solutions with examples from biologically relevant molecules. Introduces kinetics and chemical thermodynamics with examples from biological systems. Offers students an opportunity to obtain a framework for understanding the chemical basis for different methods for separating and purifying biological compounds.

**Corequisite(s):** CHEM 1162, CHEM 1163

**Attribute(s):** NUpath Natural/Designed World

**CHEM 1162. Lab for CHEM 1161. (1 Hour)**

Accompanies CHEM 1161. Introduces basic laboratory techniques. Covers a range of topics including qualitative and quantitative analysis and the characteristics of chemical and physical processes.

**Corequisite(s):** CHEM 1161, CHEM 1163

**CHEM 1163. Recitation for CHEM 1161. (0 Hours)**

Accompanies CHEM 1161. Covers various topics from the course. Offers students an opportunity to work interactively with instructors and other students to learn and apply the knowledge acquired in lecture.

**Corequisite(s):** CHEM 1161, CHEM 1162

**CHEM 1211. General Chemistry 1. (4 Hours)**

Introduces the principles of chemistry, focusing on the states and structure of matter and chemical stoichiometry. Presents basic concepts and definitions, moles, gas laws, atomic structure, periodic properties and chemical bonding, all within a contextual framework.

**Corequisite(s):** CHEM 1212, CHEM 1213

**Attribute(s):** NUpath Natural/Designed World

**CHEM 1212. Lab for CHEM 1211. (1 Hour)**

Accompanies CHEM 1211. Covers a range of topics from the course including qualitative and quantitative analysis and the characteristics of chemical and physical processes.

**Corequisite(s):** CHEM 1211, CHEM 1213

**CHEM 1213. Recitation for CHEM 1211. (0 Hours)**

Accompanies CHEM 1211. Covers various topics from the course.

**Corequisite(s):** CHEM 1211, CHEM 1212

**CHEM 1214. General Chemistry 2. (4 Hours)**

Continues CHEM 1211. Introduces the principles of chemical equilibrium, the rates and mechanisms of chemical reactions, and energy considerations in chemical transformations. Covers solutions, chemical kinetics, chemical equilibria, chemical thermodynamics, electrochemistry, and chemistry of the representative elements. Such contextual themes as energy resources, smog formation, and acid rain illustrate the principles discussed.

**Prerequisite(s):** CHEM 1211 with a minimum grade of D

**Corequisite(s):** CHEM 1215, CHEM 1216

**Attribute(s):** NUpath Natural/Designed World

**CHEM 1215. Lab for CHEM 1214. (1 Hour)**

Accompanies CHEM 1214. Covers a range of topics from the course, such as measurements of heat transfer, rate and equilibrium constants, and the effects of temperature and catalysts. Particular attention is paid to aqueous acid-base reactions and to the properties and uses of buffer systems. Quantitative analysis of chemical and physical systems is emphasized throughout.

**Corequisite(s):** CHEM 1214, CHEM 1216

**CHEM 1216. Recitation for CHEM 1214. (0 Hours)**

Accompanies CHEM 1214. Covers various topics from the course.

**Corequisite(s):** CHEM 1214, CHEM 1215

**CHEM 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHEM 2117. Chemistry in Culture. (4 Hours)**

Offers an examination of the social, cultural, and historical implications associated with the field of chemistry. Builds on a basic understanding of chemistry to explain the important role of the field of chemistry in historical and current events. May be offered as part of a study abroad program with a focus on the culture and history of the host country. May be repeated three times.

**Prerequisite(s):** CHEM 1151 with a minimum grade of C- or (CHEM 1161 with a minimum grade of C- ; CHEM 1162 with a minimum grade of C- ) or (CHEM 1214 with a minimum grade of C- ; CHEM 1215 with a minimum grade of C- )

**CHEM 2161. Concepts in Chemistry. (4 Hours)**

Explores basic concepts of thermodynamics; electrochemistry; and nuclear, supramolecular, and solid-state chemistry in the context of modern materials. Emphasizes connecting the particulate nature of matter to the properties of substances and patterns of chemical reactivity.

**Prerequisite(s):** (CHEM 1161 with a minimum grade of C- )

**Corequisite(s):** CHEM 2162, CHEM 2163

**Attribute(s):** NUpath Writing Intensive

**CHEM 2162. Lab for CHEM 2161. (1 Hour)**

Accompanies CHEM 2161. Offers hands-on exploration of the basic concepts of electrochemistry and of nuclear, supramolecular, and solid-state chemistry.

**Corequisite(s):** CHEM 2161, CHEM 2163

**CHEM 2163. Recitation for CHEM 2161. (0 Hours)**

Accompanies CHEM 2161. Covers various topics from the course. Offers students an opportunity to work interactively with instructors and other students to learn and apply the knowledge acquired in lecture.

**Corequisite(s):** CHEM 2161, CHEM 2162

**CHEM 2311. Organic Chemistry 1. (4 Hours)**

Introduces nomenclature, preparation, properties, stereochemistry, and reactions of common organic compounds. Presents correlations between the structure of organic compounds and their physical and chemical properties, and mechanistic interpretation of organic reactions. Includes chemistry of hydrocarbons and their functional derivatives.

**Prerequisite(s):** CHEM 1151 with a minimum grade of D or CHEM 1214 with a minimum grade of D or CHEM 1220 with a minimum grade of D or CHEM 1161 with a minimum grade of D

**Corequisite(s):** CHEM 2312

**CHEM 2312. Lab for CHEM 2311. (1 Hour)**

Accompanies CHEM 2311. Introduces basic laboratory techniques, such as distillation, crystallization, extraction, chromatography, characterization by physical methods, and measurement of optical rotation. These techniques serve as the foundation for the synthesis, purification, and characterization of products from microscale syntheses integrated with CHEM 2311.

**Corequisite(s):** CHEM 2311

**CHEM 2313. Organic Chemistry 2. (4 Hours)**

Continues CHEM 2311. Focuses on additional functional group chemistry including alcohols, ethers, carbonyl compounds, and amines, and also examines chemistry relevant to molecules of nature. Introduces spectroscopic methods for structural identification.

**Prerequisite(s):** CHEM 2311 with a minimum grade of D or CHEM 2315 with a minimum grade of D

**Corequisite(s):** CHEM 2314

**CHEM 2314. Lab for CHEM 2313. (1 Hour)**

Accompanies CHEM 2313. Basic laboratory techniques from CHEM 2312 are applied to chemical reactions of alcohols, ethers, carbonyl compounds, carbohydrates, and amines. Introduces basic laboratory techniques including infrared (IR) spectroscopy and nuclear magnetic resonance (NMR) spectrometry as analytical methods for characterization of organic molecules.

**Corequisite(s):** CHEM 2313

**CHEM 2315. Organic Chemistry 1 for Chemistry Majors. (4 Hours)**

Reviews the basics of bonding and thermodynamics of organic compounds as well as conformational and stereochemical considerations. Presents the structure, nomenclature, and reactivity of hydrocarbons and their functional derivatives. Highlights key reaction mechanisms, providing an introduction to the methodology of organic synthesis.

**Prerequisite(s):** CHEM 1161 with a minimum grade of C- or CHEM 1214 with a minimum grade of C- or CHEM 1220 with a minimum grade of C-

**Corequisite(s):** CHEM 2316, CHEM 2324

**CHEM 2316. Lab for CHEM 2315. (2 Hours)**

Accompanies CHEM 2315. Introduces basic laboratory techniques, such as distillation, crystallization, extraction, chromatography, characterization by physical methods, and measurement of optical rotation. These techniques serve as the foundation for the synthesis, purification, and characterization of products from microscale syntheses integrated with CHEM 2315.

**Corequisite(s):** CHEM 2315, CHEM 2324

**CHEM 2317. Organic Chemistry 2 for Chemistry Majors. (4 Hours)**

Continues CHEM 2315. Extends the study of functional groups commonly found in organic compounds, further emphasizing conceptual mastery of the relationship between structure and reactivity. Introduces structural identification of organic compounds using contemporary spectroscopic methods such as IR, MS, and NMR. Other topics include structure and reactivity of conjugated and aromatic systems, the chemistry of ethers and epoxides, and the chemistry of carbonyl-containing compounds including aldehydes, ketones, carboxylic acids, and carboxylic acid derivatives. Offers students an opportunity to develop skills in planning multistep syntheses using the retrosynthesis approach and proposing mechanisms for chemical transformations.

**Prerequisite(s):** CHEM 2311 with a minimum grade of C- or CHEM 2315 with a minimum grade of C-

**Corequisite(s):** CHEM 2318, CHEM 2325

**Attribute(s):** NUpath Creative Express/Innov

**CHEM 2318. Lab for CHEM 2317. (2 Hours)**

Accompanies CHEM 2317. Introduces basic laboratory techniques including infrared (IR) spectroscopy and nuclear magnetic resonance (NMR) spectrometry as analytical methods for characterization of organic molecules. These methods serve as the basis for characterization of products from microscale syntheses.

**Corequisite(s):** CHEM 2317, CHEM 2325

**CHEM 2321. Analytical Chemistry. (4 Hours)**

Introduces the principles and practices in the field of analytical chemistry. Focuses on development of a quantitative understanding of homogeneous and heterogeneous equilibria phenomena as applied to acid-base and complexometric titrations, rudimentary separations, optical spectroscopy, electrochemistry, and statistics.

**Prerequisite(s):** (CHEM 1151 with a minimum grade of C- or CHEM 1214 with a minimum grade of C- or CHEM 1220 with a minimum grade of C- or CHEM 1161 with a minimum grade of C- ); (CHEM 2311 with a minimum grade of C- or CHEM 2315 with a minimum grade of C- )

**Corequisite(s):** CHEM 2322, CHEM 2323

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Writing Intensive

**CHEM 2322. Lab for CHEM 2321. (1 Hour)**

Accompanies CHEM 2321. Lab experiments provide hands-on experience in the analytical methods introduced in CHEM 2321, specifically, silver chloride gravimetry, complexometric titrations, acid-base titrations, UV-vis spectroscopy, cyclic voltammetry, Karl Fischer coulometry, and modern chromatographic methods.

**Corequisite(s):** CHEM 2321, CHEM 2323

**CHEM 2323. Recitation for CHEM 2321. (0 Hours)**

Accompanies CHEM 2321 and CHEM 2322. Covers various topics from the course. Offers students an opportunity to work interactively with instructors and other students to learn and apply the knowledge acquired in lecture and lab.

**Corequisite(s):** CHEM 2321, CHEM 2322

**CHEM 2324. Recitation for CHEM 2315. (0 Hours)**

Accompanies CHEM 2315 and CHEM 2316. Offers students an opportunity to work interactively with instructors and other students to learn and apply the knowledge acquired in lab and lecture.

**Corequisite(s):** CHEM 2315, CHEM 2316

**CHEM 2325. Recitation for CHEM 2317. (0 Hours)**

Accompanies CHEM 2317 and CHEM 2318. Offers students an opportunity to work interactively with instructors and other students to learn and apply the knowledge acquired in lab and lecture.

**Corequisite(s):** CHEM 2317, CHEM 2318

**CHEM 2326. Introduction to Green Chemistry and Toxicology. (4 Hours)**

Focuses on how chemistry can help us address global environmental issues of pollution, sustainable molecular design, and reimagining the chemical enterprise through the lenses of the 12 principles of green chemistry, sustainability, and introductory toxicology. Discussions link foundational principles such as physical and chemical properties of molecules, organic nomenclature, functionality, and polymerization processes. Relates topics to principles of toxicology, bioaccumulation, pollution from industrial practices, and how green chemistry applies to environmental and human health issues and proposed solutions.

**Prerequisite(s):** (CHEM 1151 with a minimum grade of C- or CHEM 1161 with a minimum grade of C- or CHEM 1214 with a minimum grade of C- ); (CHEM 2311 (may be taken concurrently) with a minimum grade of C- or CHEM 2315 (may be taken concurrently) with a minimum grade of C- )

**CHEM 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHEM 2991. Research in Chemistry and Chemical Biology. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated seven times.

**CHEM 3100. Cosmetic Chemistry: Design and Innovation. (4 Hours)**

Surveys the chemical principles (composition/structure) underlying the design of personal care products. Discusses fundamental knowledge of emulsion chemistry, reaction kinetics/dynamics, formulation design/testing, and stability assessments, as they relate to material selection. Emphasizes first identifying then assembling appropriate ingredient lists that create products (creams, serums, cleansers, hair colorants) to meet the regulatory and quality control standards set by the industry.

**Prerequisite(s):** CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C-

**Corequisite(s):** CHEM 3101

**CHEM 3101. Lab for CHEM 3100. (1 Hour)**

Accompanies CHEM 3100. Focuses on the design of cosmetic products in a project-based lab. Students work in teams randomly assigned at the start of the semester to execute each lab. The design process associated with each lab includes strategy and concept generation, estimation, and prototyping. Emphasizes the development of creative designs that are motivated by content learned through the lecture. Includes a significant communication component as students present ideas in class. Students also write a publication-quality final paper, which they will be encouraged to submit to a conference or journal as part of their final project presentations in the lecture.

**Corequisite(s):** CHEM 3100

**CHEM 3131. Forensic Chemistry. (4 Hours)**

Surveys the important chemical principles and techniques used in forensic science and crime scene analysis. Covers the collection and preservation of evidence, serology, hair and fiber, DNA, drugs analysis and identification, toxicology, firearms, and arson/explosives analysis. Uses hands-on experiments to offer students an opportunity to understand techniques used by forensic scientists.

**Prerequisite(s):** CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C-

**CHEM 3331. Bioanalytical Chemistry. (4 Hours)**

Offers students an opportunity to obtain a broad familiarity with bioanalytical chemistry at the undergraduate level. After reviewing basic principles of analytical chemistry, the course covers biomolecular analysis by modern methods, including chromatography, electrophoresis, mass spectrometry, and immunohistochemistry. Studies genomics, proteomics, biosensors, bioassays, and protein/DNA sequencing. Exposes students to technical literature and modern applications in biochemistry, molecular biology, and chemistry.

**Prerequisite(s):** (CHEM 1151 with a minimum grade of C- or CHEM 1161 with a minimum grade of C- or CHEM 1214 with a minimum grade of C- or CHEM 1220 with a minimum grade of C- ); (CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C- ); (CHEM 2321 with a minimum grade of C- or BIOL 3611 with a minimum grade of C- ); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Corequisite(s):** CHEM 3332

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Writing Intensive

**CHEM 3332. Lab for CHEM 3331. (1 Hour)**

Accompanies CHEM 3331. Offers students an opportunity to apply modern analytical instrumentation to a selection of relevant applications as they relate to research and development labs in the biotechnology and pharmaceutical industry.

**Corequisite(s):** CHEM 3331

**CHEM 3401. Chemical Thermodynamics and Kinetics. (4 Hours)**

Traces the development of chemical thermodynamics through the three major laws of thermodynamics. These are applied to thermochemistry, chemical reaction and phase equilibria, and the physical behavior of multicomponent systems. Emphasizes quantitative interpretation of physical measurements.

**Prerequisite(s):** (MATH 1252 with a minimum grade of C- or MATH 1342 with a minimum grade of C- ); (CHEM 1214 with a minimum grade of C- or CHEM 1151 with a minimum grade of C- or CHEM 1161 with a minimum grade of C- ); (PHYS 1151 with a minimum grade of C- or PHYS 1161 with a minimum grade of C- )

**Corequisite(s):** CHEM 3402

**CHEM 3402. Lab for CHEM 3401. (1 Hour)**

Accompanies CHEM 3401. Demonstrates the measurement of selected physical chemical phenomena presented in CHEM 3401, introducing experimental protocol and methods of data analysis. Experiments include investigations of gas nonideality and critical phenomena, electrochemical measurement of equilibrium, construction of phase diagrams, and bomb and differential scanning calorimetry.

**Corequisite(s):** CHEM 3401

**CHEM 3403. Quantum Chemistry and Spectroscopy. (4 Hours)**

Studies the theory of quantum chemistry with applications to spectroscopy. Presents some simple quantum mechanical (QM) models, including the particle in a box, rigid rotor, and harmonic oscillator, followed by treatments of electrons in atoms and molecules. Microwave, infrared, Raman, NMR, ESR, atomic absorption, atomic emission, and UV-Vis spectroscopy are discussed in detail.

**Prerequisite(s):** (CHEM 3401 with a minimum grade of C- or CHEM 3421 with a minimum grade of C- or CHEM 3431 with a minimum grade of C- or CHME 3322 with a minimum grade of C- ); MATH 1342 with a minimum grade of C- ; (PHYS 1155 with a minimum grade of C- or PHYS 1165 with a minimum grade of C- )

**Corequisite(s):** CHEM 3404

**CHEM 3404. Lab for CHEM 3403. (1 Hour)**

Accompanies CHEM 3403. Explores the principles covered in CHEM 3403 by laboratory experimentation. Experiments include measurement of reaction kinetics, such as excited state dynamics, measurement of gas transport properties, atomic and molecular absorption and emission spectroscopy, infrared spectroscopy of molecular vibrations, and selected applications of fluorimetry.

**Corequisite(s):** CHEM 3403

**CHEM 3410. Environmental Geochemistry. (4 Hours)**

Offers students who wish to work in the geosciences or environmental science and engineering fields, including on the land, in freshwater, or the oceans, an opportunity to understand the geochemical principles that shape the natural and managed environment. Seeks to provide a context for understanding the natural elemental cycles and environmental problems through studies in atmospheric, terrestrial, freshwater, and marine geochemistry. Topics include fundamental geochemical principles; environmental mineralogy; organic and isotope geochemistry; the global carbon, nitrogen, and phosphorous cycles; atmospheric pollution; environmental photochemistry; and human-natural climate change feedbacks.

**Prerequisite(s):** CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1214 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**CHEM 3431. Physical Chemistry. (4 Hours)**

Offers an in-depth survey of physical chemistry. Emphasizes applications in modern research, including examples from biochemistry. Topics include the laws of thermodynamics and their molecular interpretation; equilibrium in chemical and biochemical systems; molecular transport; kinetics, including complex enzyme mechanisms; and an introduction to spectroscopy and the underlying concepts of quantum chemistry.

**Prerequisite(s):** ((CHEM 1214 with a minimum grade of C- or CHEM 1220 with a minimum grade of C-) or (CHEM 1151 with a minimum grade of C- or CHEM 1161 with a minimum grade of C-)); (MATH 1252 with a minimum grade of C- or MATH 1342 with a minimum grade of C-); (PHYS 1147 with a minimum grade of C- or PHYS 1155 with a minimum grade of C- or PHYS 1165 with a minimum grade of C- or PHYS 1175 with a minimum grade of C-)

**Corequisite(s):** CHEM 3432

**CHEM 3432. Lab for CHEM 3431. (1 Hour)**

Accompanies CHEM 3431. Covers practical skills in physical chemistry with an emphasis on current practice in chemistry, biochemistry, and pharmaceutical science. Introduces both ab initio and biological molecular modeling, differential scanning calorimetry, polymer characterization, protein unfolding and protein/ligand binding, electronic absorption spectroscopy, and synthesis of nanoparticles or quantum dots.

**Corequisite(s):** CHEM 3431

**CHEM 3501. Inorganic Chemistry. (4 Hours)**

Presents the following topics: basic concepts of molecular topologies, coordination compounds, coordination chemistry, isomerism, electron-transfer reactions, substitution reactions, molecular rearrangements and reactions at ligands, and biochemical applications.

**Prerequisite(s):** (CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C-); (CHEM 2321 with a minimum grade of C- or CHEM 2331 with a minimum grade of C- or CHEM 3331 with a minimum grade of C-)

**Corequisite(s):** CHEM 3502, CHEM 3503

**Attribute(s):** NUpath Writing Intensive

**CHEM 3502. Lab for CHEM 3501. (1 Hour)**

Offers a laboratory course in inorganic chemistry with experiments and projects that track with the topics discussed in CHEM 3501. Designed to provide laboratory experience with the synthesis of coordination compounds and with the instrumental methods used to characterize them.

**Corequisite(s):** CHEM 3501, CHEM 3503

**CHEM 3503. Recitation for CHEM 3501. (0 Hours)**

Offers students additional opportunities to work interactively with instructors and other students to learn and apply the concepts presented in CHEM 3501.

**Corequisite(s):** CHEM 3501, CHEM 3502

**CHEM 3505. Introduction to Bioinorganic Chemistry. (4 Hours)**

Explores basic concepts of molecular topologies, coordination compounds, coordination chemistry, isomerism, electron-transfer reactions, substitution reactions, molecular rearrangements, and reactions at ligands in the context of metal-based drugs, imaging agents, and metalloenzymes.

**Prerequisite(s):** (CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C- ); (CHEM 2321 with a minimum grade of C- or CHEM 2331 with a minimum grade of C- or CHEM 3331 with a minimum grade of C- )

**Corequisite(s):** CHEM 3506, CHEM 3507

**Attribute(s):** NUpath Writing Intensive

**CHEM 3506. Lab for CHEM 3505. (1 Hour)**

Offers a laboratory course in inorganic chemistry with experiments and projects that track with the topics discussed in CHEM 3505. Designed for students who have mastered basic laboratory techniques in general and organic chemistry. Introduces new synthetic techniques and applies modern analytical characterization tools not previously used in other laboratory courses (such as CHEM 3522 and CHEM 3532).

**Corequisite(s):** CHEM 3505, CHEM 3507

**CHEM 3507. Recitation for CHEM 3505. (0 Hours)**

Offers students additional opportunities to work interactively with instructors and other students to learn and apply the concepts presented in CHEM 3505.

**Corequisite(s):** CHEM 3505, CHEM 3506

**CHEM 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHEM 4456. Organic Chemistry 3: Organic Chemistry of Drug Design and Development. (4 Hours)**

Studies how to apply principles of organic chemistry, and related areas of chemistry, to the design, preparation, and use of biologically active organic compounds. Explores translational chemical science in the discovery, design, and development of biologically active compounds for medical purposes, using techniques gained in organic reaction mechanisms and synthesis. Evaluates methods to incorporate specific chemical features into organic compounds to meet specific biological and biomedical criteria. Offers students an opportunity to develop problem-solving skills that extend beyond synthetic organic chemistry to a wide range of chemical disciplines.

**Prerequisite(s):** CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C-

**CHEM 4457. Lab for CHEM 4456. (1 Hour)**

Accompanies CHEM 4456. Integrates elements of experimental design, organic synthesis, isolation and characterization of organic compounds, and interpretation of experimental observations. Students, working in small groups, evaluate a multistep synthesis of a compound developed for clinical trials as an anticancer agent, conducting the synthetic sequence, completing each reaction, characterizing the products, and interpreting and reporting the results. A final report in the form of an American Chemical Society (ACS) manuscript summarizes each group's efforts.

**Corequisite(s):** CHEM 4456

**CHEM 4628. Introduction to Spectroscopy of Organic Compounds. (4 Hours)**

Examines the application of modern spectroscopic techniques to the structural elucidation of small organic molecules. Emphasizes the use of H and C NMR spectroscopy supplemented with information from infrared spectroscopy and mass spectrometry. Explores both the practical and nonmathematical theoretical aspects of 1D and 2D NMR experiments. Topics include the chemical shift, coupling constants, the nuclear Overhauser effect and relaxation, and 2D homonuclear and heteronuclear correlation. Designed for chemists who do not have an extensive math or physics background; no prior knowledge of NMR spectroscopy is assumed.

**Prerequisite(s):** CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C-

**Corequisite(s):** CHEM 4629

**CHEM 4629. Identification of Organic Compounds. (2 Hours)**

Introduces the use of the nuclear magnetic resonance (NMR) spectrometer and basic NMR experiments. Determines the identity of unknown organic compounds by the use of mass spectrometry, infrared spectroscopy, and 1D and 2D nuclear magnetic resonance spectroscopy.

**Prerequisite(s):** CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C-

**Corequisite(s):** CHEM 4628

**CHEM 4750. Senior Research. (4 Hours)**

Conducts original experimental work under the direction of members of the department on a project. Introduces experimental design based on literature and a variety of techniques depending upon the individual project.

**Prerequisite(s):** CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CHEM 4901. Undergraduate Research. (4 Hours)**

Conducts original research under the direction of members of the department. May be repeated without limit.

**Prerequisite(s):** CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C- or CHEM 2321 with a minimum grade of C-

**Attribute(s):** NUpath Integration Experience

**CHEM 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated without limit.

**Attribute(s):** NUpath Capstone Experience

**CHEM 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** CHEM 4970 with a minimum grade of C

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CHEM 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHEM 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**CHEM 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**CHEM 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**CHEM 5501. Chemical Safety in the Research Laboratory. (1 Hour)**

Covers the material needed to complete successfully all the online safety training that is required for our graduate students, best practices for the safe execution of common chemical laboratory procedures, advanced procedures, as well as incidents from the recent literature. Includes discussions of case studies on topics relevant for the safe and effective use of chemicals and other materials in a research laboratory environment. Undergraduates may enroll with permission of the instructor. May be repeated two times.

**CHEM 5550. Introduction to Glycobiology and Glycoprotein Analysis. (3 Hours)**

Covers the background and methods used for glycoprotein characterization. Offers students an opportunity to obtain the background needed to assess the analytical steps necessary for development of glycoprotein drugs. Analyzes regulatory issues behind glycoprotein drug development. Covers recent developments in analytical and regulatory sciences.

**CHEM 5599. Introduction to Research Skills and Ethics in Chemistry. (0 Hours)**

Seeks to prepare students for success in CHEM 5600 and in CHEM 7730. May be repeated once. Must be taken in consecutive semesters before registration into CHEM 5600 and CHEM 7730.

**CHEM 5600. Research Skills and Ethics in Chemistry. (3 Hours)**

Discusses ethics in science. Topics include documentation of work in your laboratory notebook, safety in a chemistry research laboratory, principles of experimental design, online computer searching to access chemical literature, reading and writing technical journal articles, preparation and delivery of an effective oral presentation, and preparation of a competitive research proposal.

**Prerequisite(s):** CHEM 5599 with a minimum grade of S

**CHEM 5610. Polymer Chemistry. (3 Hours)**

Discusses the synthesis and analysis of polymer materials. Covers mechanisms and kinetics of condensation/chain-growth polymerization reactions and strategies leading to well-defined polymer architectures and compositions, including living polymerizations (free radical, cationic, anionic), catalytic approaches, and postpolymerization functionalization. Discusses correlation of chemical composition and structure to physical properties and applications.

**Prerequisite(s):** ((CHEM 2317 with a minimum grade of C- or CHEM 2313 with a minimum grade of C-); (CHEM 3401 (may be taken concurrently) with a minimum grade of C- or CHEM 3421 (may be taken concurrently) with a minimum grade of C- or CHEM 3431 (may be taken concurrently) with a minimum grade of C-)) or graduate program admission

**CHEM 5611. Analytical Separations. (3 Hours)**

Describes the theory and practice of separating the components of complex mixtures in the gas and liquid phase. Also includes methods to enhance separation efficiency and detection sensitivity. Covers thin-layer, gas, and high-performance liquid chromatography (HPLC) and recently developed techniques based on HPLC including capillary and membrane-based separation, and capillary electrophoresis.

**CHEM 5612. Principles of Mass Spectrometry. (3 Hours)**

Describes the theory and practice of ion separation in electrostatic and magnetic fields and their subsequent detection. Topics include basic principles of ion trajectories in electrostatic and magnetic fields, design and operation of inlet systems and electron impact ionization, and mass spectra of organic compounds.

**CHEM 5614. Electroanalytical Chemistry. (3 Hours)**

Describes the theory of electrode processes and modern electroanalytical experiments. Topics include the nature of the electrode-solution interface (double layer models), mass transfer (diffusion, migration, and convection), types of electrodes, reference electrodes, junction potentials, kinetics of electrode reactions, controlled potential methods (cyclic voltammetry, chronoamperometry), chronocoulometry and square wave voltammetry, and controlled current methods (chronopotentiometry).

**CHEM 5617. Protein Mass Spectrometry Laboratory. (3 Hours)**

Offers students an opportunity to develop an appreciation of the appropriate choice of mass spectrometer for a particular application.

**CHEM 5620. Protein Chemistry. (3 Hours)**

Describes proteins (what they are, where they come from, and how they work) in the context of analytical analysis and molecular medicine. Discusses the chemical properties of proteins, protein synthesis, and the genetic origins of globular proteins in solution, membrane proteins, and fibrous proteins. Covers the physical intra- and intermolecular interactions that proteins undergo along with descriptions of protein conformation and methods of structural determination. Explores protein folding as well as protein degradation and enzymatic activity. Highlights protein purification and biophysical characterization in relation to protein analysis, drug design, and optimization.

**Prerequisite(s):** CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C- or graduate program admission

**CHEM 5621. Principles of Chemical Biology. (3 Hours)**

Explores the use of natural and unnatural small-molecule chemical tools to probe macromolecules, including affinity labeling and click chemistry. Covers nucleic acid sequencing technologies and solid-phase synthesis of nucleic acids and peptides. Discusses in-vitro selection techniques, aptamers, and quantitative issues in library construction. Uses molecular visualization software tools to investigate structures of macromolecules. Intended for graduate and advanced undergraduate students.

**Prerequisite(s):** ((CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C-); (CHEM 2321 with a minimum grade of C- or CHEM 2331 with a minimum grade of C- or CHEM 3331 with a minimum grade of C-); (CHEM 3401 (may be taken concurrently) with a minimum grade of C- or CHEM 3421 (may be taken concurrently) with a minimum grade of C- or CHEM 3431 (may be taken concurrently) with a minimum grade of C-)) or graduate program admission

**CHEM 5622. Lab for CHEM 5621. (1 Hour)**

Accompanies CHEM 5621. Complements and reinforces the concepts from CHEM 5621 with emphasis on fundamental techniques. Offers an opportunity to complete independent projects in modern chemical biology research.

**Prerequisite(s):** ((CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C-); (CHEM 2321 with a minimum grade of C- or CHEM 2331 with a minimum grade of C- or CHEM 3331 with a minimum grade of C-); (CHEM 3401 (may be taken concurrently) with a minimum grade of C- or CHEM 3421 (may be taken concurrently) with a minimum grade of C- or CHEM 3431 (may be taken concurrently) with a minimum grade of C-); (ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C)) or graduate program admission

**Attribute(s):** NUPath Writing Intensive

**CHEM 5625. Chemistry and Design of Protein Pharmaceuticals. (3 Hours)**

Covers the chemical transformations and protein engineering approaches to protein pharmaceuticals. Describes protein posttranslational modifications, such as oxidation, glycosylation, formation of isoaspartic acid, and disulfide. Then discusses bioconjugate chemistry, including those involved in antibody-drug conjugate and PEGylation. Finally, explores various protein engineering approaches, such as quality by design (QbD), to optimize the stability, immunogenicity, activity, and production of protein pharmaceuticals. Discusses the underlying chemical principles and enzymatic mechanisms as well.

**Prerequisite(s):** (CHEM 2317 with a minimum grade of C- or CHEM 2313 with a minimum grade of C- or graduate program admission); (CHEM 5620 (may be taken concurrently) with a minimum grade of C- or CHEM 5620 (may be taken concurrently) with a minimum grade of C- or CHEM 5621 (may be taken concurrently) with a minimum grade of C- or CHEM 5621 (may be taken concurrently) with a minimum grade of C-)

**CHEM 5626. Organic Synthesis 1. (3 Hours)**

Surveys types of organic reactions including stereochemistry, influence of structure and medium, mechanistic aspects, and synthetic applications.

**CHEM 5627. Mechanistic and Physical Organic Chemistry. (3 Hours)**

Surveys foundational concepts of physical organic chemistry, including thermodynamics, kinetics, and solvent and isotope effects. Treats structure/reactivity relationships in the context of how they can be used in understanding and predicting organic chemistry mechanisms. Topics include conformational analysis, molecular orbital theory, aromaticity, orbital symmetry, and how they are applied to understanding organic and organometallic reactions such as aldol, pericyclic, and other stereoselective reactions. Discusses reaction mechanisms that involve intermediates, including anions, cations, radicals, and carbenes.

**CHEM 5628. Principles of Spectroscopy of Organic Compounds. (3 Hours)**

Studies how to determine organic structure based on proton and carbon nuclear magnetic resonance spectra, with additional information from mass and infrared spectra and elemental analysis. Presents descriptive theory of nuclear magnetic resonance experiments and applications of advanced techniques to structure determination. Includes relaxation, nuclear Overhauser effect, polarization transfer, and correlation in various one- and two-dimensional experiments. Requires graduate students to have one year of organic chemistry or equivalent.

**Prerequisite(s):** CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C- or graduate program admission

**CHEM 5630. Nucleic Acid Chemistry. (3 Hours)**

Offers a broadband introduction to the field of nucleic acid chemistry. Nucleic acids are vital for biology, but their roles have been greatly expanded beyond storage of genetic information. The breadth of utility of nucleic acids stems from a precise understanding of their structures, modern means to synthesize and modify them, and the ability for nucleic acids to engage with varieties of enzymes/proteins and other synthetic/biological systems. Foundational topics include nucleic acid structure, physicochemical properties, syntheses of nucleosides/nucleotides/oligonucleotides, chemical modification of nucleic acids, methods to manipulate and analyze nucleic acids (e.g., PCR, sequencing, and electrophoresis). Advanced topics include nucleic acid therapeutics (e.g., siRNA, antisense technology, CRISPR, and aptamers); DNA damage and repair; and DNA for materials science (e.g., DNA nanotechnology).

**CHEM 5631. Lab for CHEM 5628. (1 Hour)**

Accompanies CHEM 5628. Offers hands-on experience with instrumentation and data processing necessary for the characterization of organic compounds. Emphasizes nuclear magnetic resonance spectroscopy techniques to differentiate chemical compounds and enable associations between chemical structure and spectroscopic data.

**Corequisite(s):** CHEM 5628

**CHEM 5636. Statistical Thermodynamics. (3 Hours)**

Briefly reviews classical thermodynamics before undertaking detailed coverage of statistical thermodynamics, including probability theory, the Boltzmann distribution, partition functions, ensembles, and statistically derived thermodynamic functions. Reconsiders the basic concepts of statistical thermodynamics from the modern viewpoint of information theory. Presents practical applications of the theory to problems of contemporary interest, including polymers and biopolymers, nanoscale systems, molecular modeling, and bioinformatics.

**Prerequisite(s):** CHEM 3401 with a minimum grade of C- or CHEM 3421 with a minimum grade of C- or CHEM 3431 with a minimum grade of C- or graduate program admission

**CHEM 5638. Molecular Modeling. (3 Hours)**

Introduces molecular modeling methods that are basic tools in the study of macromolecules. Is structured partly as a practical laboratory using a popular molecular modeling suite, and also aims to elucidate the underlying physical principles upon which molecular mechanics is based. These principles are presented in supplemental lectures or in laboratory workshops.

**CHEM 5640. Biopolymeric Materials. (3 Hours)**

Examines the structure, properties, and processing of biomaterials, the forms of matter that are produced by or interact with biological systems. One of the pillars of biomedical engineering is to use naturally derived and synthetic biomaterials to treat, augment, or replace human tissues.

**CHEM 5641. Computational Chemistry. (3 Hours)**

Introduces basic concepts, methods, techniques, and recent advances in computational chemistry and their relevance to experimental characterizations such as spectroscopy. Topics include electronic structure theory (wave function theory and density functional theory), principles of molecular dynamics simulations, multiscale modeling, machine learning, and quantum computing relevant to computational chemistry. Builds a theoretical foundation for students to properly choose computational methods to solve common research problems in chemistry, biochemistry, and materials science. Also introduces the field of research in computational chemistry. Suitable for advanced undergraduate students and graduate students who plan to conduct research in the field of computational chemistry or plan to utilize computational techniques to complement experimental research in the molecular sciences.

**CHEM 5642. Photochemistry Fundamentals and Applications. (3 Hours)**

Describes fundamental science of light-activated chemistry and photochemistry applications. Topics include organic and inorganic photochemistry and their applications in solar energy, solar fuels, photocatalysis, bioimaging, photochemotherapy, pigments, and photonics.

**Prerequisite(s):** (CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D-) or graduate program admission

**CHEM 5643. Plastics Sustainability and Circular Economy: A Chemical Perspective. (3 Hours)**

Explores the measures taken by both academia and industry to address plastic pollution and to integrate these materials into circular economy systems. Examines plastic pollution from a chemical perspective by delving into the properties of polymers and their composites at the molecular level, aiming to understand the root causes of this pervasive problem. Offers students an opportunity to obtain a deeper understanding of the challenges posed by plastic pollution and the innovative solutions being developed to combat it.

**CHEM 5648. Chemical Principles and Application of Drug Metabolism and Pharmacokinetics. (3 Hours)**

Offers students an opportunity to obtain a comprehensive grounding in the chemistry of drug metabolism and pharmacokinetics (DMPK) and its application to drug design and optimization. Multiple rounds of chemical synthesis and testing are usually required to discover new drugs with the appropriate balance of properties such as potency and selectivity, efficacy in preclinical models of disease, safety, and pharmacokinetics. Introduces students to modern tools and concepts utilized to screen for favorable DMPK properties, as well as methods to predict human PK from in vitro and preclinical data. Examines the linkage between drug levels in the body, pharmacodynamic response (PK/PD), and drug-drug interactions in the context of the iterative process of chemical drug synthesis.

**CHEM 5649. Numerical Strategies and Data Analytics for Chemical Sciences. (4 Hours)**

Introduces a broad range of numerical methods for solving large-scale, data-driven problems that arise in chemical engineering, chemistry, biochemistry, and other chemical sciences. Offers students an opportunity to obtain a detailed understanding of the derivation, analysis, and use of these numerical methods and learn how these lay the foundations to machine learning techniques. Topics include numerical programming logic, linear and nonlinear algebraic equations, polynomial fitting, numerical calculus, optimization techniques, and large-scale data analysis. Applies to a broad field of chemical and biochemical sciences, where large-scale multivariate data analyses and pattern extraction are key components.

**Prerequisite(s):** ((MATH 1341 with a minimum grade of D- ; MATH 1342 with a minimum grade of D- ) or (MATH 2321 with a minimum grade of D- ; MATH 2341 with a minimum grade of D- )) or graduate program admission

**CHEM 5651. Materials Chemistry of Renewable Energy. (3 Hours)**

Studies renewable energy in terms of photovoltaics, photoelectrochemistry, fuel cells, batteries, and capacitors. Focuses on the aspects of each component and their relationships to one another.

**Prerequisite(s):** ((CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C- ); CHEM 3401 with a minimum grade of C- or CHEM 3431 with a minimum grade of C- ) or graduate program admission

**CHEM 5653. Electrochemistry of Renewable Energy Devices. (1 Hour)**

Presents the electrochemistry of renewable energy, an extremely interdisciplinary science encompassing sensors, surface technology, materials science, microsystems technology, nanotechnology, energy storage, and conversion. Offers experience with characterization of energy storage and conversion devices. Emphasizes photovoltaics and batteries.

**Corequisite(s):** CHEM 5651

**CHEM 5655. Molecular Symmetry and Group Theory. (3 Hours)**

Covers symmetry operations; point groups and classification of molecules into point groups; as well as matrix representation of symmetry operations, orthogonality theorem, and its use in determining irreducible representation spanned by a basis. Studies decomposition of reducible representation and direct products, characters and character tables, and reviews quantum mechanics. Also covers infrared and Raman spectroscopy, normal modes of vibrations, determining symmetry of vibrations, the role of symmetry in selection rules, LCAO MO theory, Hückel method, electronic spectroscopy, and vibronic spectroscopy and symmetry.

**CHEM 5660. Analytical Biochemistry. (3 Hours)**

Covers the analysis of biological molecules, which include nucleic acids, proteins, carbohydrates, lipids, and metabolites. Discusses isolation, characterization, and quantification of these molecules.

**CHEM 5670. Global Biogeochemistry. (4 Hours)**

Examines the biological, chemical, and physical interactions that shape our global environment. These interactions combine in the global biogeochemical cycles. Industrial emission of gases, use of fertilizers and plastics, and the expansion of cities are altering the biogeochemical cycling of the elements carbon, nitrogen, and phosphorus at rates unprecedented in the geological record. Uses lectures and the latest update to Chapter 6, "Carbon and Other Biogeochemical Cycles," of the International Panel on Climate Change report to explore the main interactions between human activity, biogeochemical change, and climate. Discusses primary literature to delve deeper into these interactions.

**Attribute(s):** NUpath Natural/Designed World

**CHEM 5672. Organic Synthesis 2. (3 Hours)**

Continues CHEM 5626. Surveys types of organic reactions including stereochemistry, influence of structure and medium, mechanistic aspects, and synthetic applications.

**Prerequisite(s):** CHEM 5626 with a minimum grade of C- or CHEM 5626 with a minimum grade of D

**CHEM 5676. Bioorganic Chemistry. (3 Hours)**

Covers host guest complexation by crown ethers, cryptands, podands, spherands, and so forth; molecular recognition including self-replication; peptide and protein structure; coenzymes and metals in bioorganic chemistry; nucleic acid structure; interaction of DNA with proteins and small molecules including DNA-targeted drug design; catalytic RNA; and catalytic antibodies.

**Prerequisite(s):** (CHEM 5626 with a minimum grade of C- ; CHEM 5627 with a minimum grade of C- ) or graduate program admission

**CHEM 5688. Principles of Nuclear Magnetic Resonance. (3 Hours)**

Presents the physical principles underlying magnetic resonance spectroscopy, including Fourier transform theory, classical and quantum-mechanical treatments of spin angular momentum, the Bloch equations, and spin relaxation. Covers fundamental concepts in time domain magnetic resonance methods, including pulse sequences, selective pulses, phase cycling, coherence pathways, field gradients, and nonuniform sampling. Surveys the NMR methods most commonly applied to chemical structural analysis, including pure shift NMR; 2D correlation (COSY, DQF-COSY, TOCSY, HSQC, HMBC) methods; and cross-relaxation (NOESY, ROESY) methods.

**CHEM 5692. Carbon Capture, Utilization, and Storage. (4 Hours)**

Discusses diverse technological approaches for carbon capture, utilization, and storage, or CCUS. Lectures cover legislative, economic, and societal considerations of realizing CCUS on a large scale. Offers students an opportunity to gain a comprehensive understanding of climate change and decarbonization problems. Students work on a miniproject on the conceptual design and evaluation of a decarbonization approach (of their choice), which can include, e.g., well-established carbon capture technologies, emerging electrochemical or biological methods, industrial energy efficiency, mineralization, carbon dioxide capture in oceans, or reforestation studies. This course is designed to help develop a solid foundation to embark on a career in a sustainability-related business or research institution.

**CHEM 5696. Organometallic Chemistry. (3 Hours)**

Presents an advanced graduate-level course in organometallic chemistry featuring both main group and transition metals. Requires an advanced undergraduate or introductory graduate course in organic chemistry and inorganic chemistry. Addresses the structure, bonding, and reactivity patterns of organometallic complexes. Topics include metal-carbon ligands, main group metals and ligands, chemistry of carbon monoxide and analogues, metal  $\pi$ -complexes, and fundamental organometallic reactions and mechanisms. Discusses applications for organometallic chemistry including sustainability, catalysis, and materials.

**Prerequisite(s):** ((CHEM 2313 with a minimum grade of C- or CHEM 2317 with a minimum grade of C- ); (CHEM 3501 (may be taken concurrently) with a minimum grade of C- or CHEM 3505 (may be taken concurrently) with a minimum grade of C- )) or graduate program admission

**CHEM 5904. Seminar. (1 Hour)**

Focuses on oral reports by master of science and PlusOne participants on current research topics in chemistry and chemical biology. May be repeated up to two times.

**CHEM 5976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**CHEM 5984. Research. (1-6 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated up to three times for up to 6 total credits.

**CHEM 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHEM 7710. Laboratory Rotations in Chemistry and Chemical Biology. (0 Hours)**

Offers an opportunity for students to gain exposure to research laboratories in the department to help them choose a thesis advisor and project.

**CHEM 7750. Advanced Problem Solving. (3 Hours)**

Designed to provide skills necessary to lead advanced problem-solving case studies. Faculty mentors in one of three thematic areas chosen from organic and medicinal chemistry, physical and materials chemistry, or analytical and biological chemistry assign casework to students for presentation and analysis in group sessions. Students are required to provide rational solutions to complex problems derived from the contemporary literature and engage in dialogue with faculty mentors to justify their analysis. The faculty mentors assign grades to reflect intellectual maturity and ability of the students to display creative, independent thinking. Full-time PhD students who have successfully completed qualifying examinations only.

**CHEM 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHEM 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**CHEM 7990. Thesis. (1-4 Hours)**

Offers thesis supervision by members of the department. May be repeated without limit.

**CHEM 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers continuing thesis supervision by members of the department.

**CHEM 8504. Graduate Seminar. (1 Hour)**

Focuses on oral reports by the participants on current research topics in chemistry and chemical biology. May be repeated without limit.

**CHEM 8960. Exam Preparation—Doctoral. (0 Hours)**

Offers the student the opportunity to prepare for and take the PhD qualifying exams (cumulative exams).

**CHEM 8984. Research. (1-6 Hours)**

Offers the chance to conduct original research, written thesis thereon, or to the establishment of doctoral candidacy. May be repeated without limit.

**CHEM 8986. Research. (0 Hours)**

Offers the student the opportunity to conduct full-time research for the master's degree. May be repeated without limit.

**CHEM 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**CHEM 9984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**CHEM 9986. Research. (0 Hours)**

Offers the student the opportunity to conduct full-time research for the PhD. May be repeated without limit.

**CHEM 9990. Dissertation Term 1. (0 Hours)**

Offers the student the opportunity to conduct theoretical and experimental research for the PhD degree. Open to chemical biology students.

**Prerequisite(s):** CHEM 9000 with a minimum grade of S

**CHEM 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** CHEM 9990 with a minimum grade of S

**CHEM 9996. Dissertation Continuation. (0 Hours)**

Offers dissertation supervision by members of the department. Open to chemical biology students.

**Prerequisite(s):** CHEM 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Chinese (CHNS)

### CHNS 1101. Elementary Chinese 1. (4 Hours)

Designed for students who have very little or no prior knowledge of Chinese. Provides a lively introduction to basic oral expression, listening comprehension, and elementary reading and writing. Each lesson incorporates helpful information about daily life in China and the varied cultures within the world of Chinese speakers. Laboratory practice complements class work, enables students to work aloud at their own speed, reinforces their acquisition of essential structures, and acquaints them with a vast library of audio-visual resources. Focuses on Mandarin Chinese; students who wish to speak another dialect of Chinese should consult instructor for proper placement.

### CHNS 1102. Elementary Chinese 2. (4 Hours)

Continues CHNS 1101. Reviews and continues the study of grammar and basic language skills. Offers progressively more intensive practice in oral and written communication. Laboratory practice complements class work, enables students to work aloud at their own speed, reinforces their acquisition of essential structures, and acquaints them with a vast library of audio-visual resources.

**Prerequisite(s):** CHNS 1101 with a minimum grade of C- or CHNS 1301 with a minimum grade of C-

### CHNS 1944. Cultural Engagement: Dialogue of Civilizations. (4 Hours)

Engages students on-site with the culture(s) of Chinese-speaking regions and/or communities. Emphasizes the complexity, transnationalism, and interdisciplinary nature of culture(s). Employs a range of methodological approaches to describe and analyze how cultural practices, objects, texts, and meanings are created, distributed, and exchanged within particular social groups or geographic areas. Explores questions of cultural identity, meaning, representation, policy formations, and ideologies. In addition to regular in-class lectures and activities, offers students an opportunity to engage in a dialogue with members of the local communities about their perspectives on relevant cultural topics and everyday experiences. May be repeated once. Conducted in English.

### CHNS 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### CHNS 2101. Intermediate Chinese 1. (4 Hours)

Seeks to consolidate the foundation built in elementary Chinese courses. Offers students an opportunity to develop higher oral proficiency, as well as reading and writing skills. Requires students to perform various tasks, such as describing, comparing, and narrating, in culturally appropriate ways.

**Prerequisite(s):** CHNS 1102 with a minimum grade of C- or CHNS 1302 with a minimum grade of C-

### CHNS 2102. Intermediate Chinese 2. (4 Hours)

Emphasizes vocabulary building and mastery of fine points of grammar through written compositions, prepared oral reports, and reading and discussions of material from everyday life to situate language learning in authentic contexts.

**Prerequisite(s):** CHNS 2101 with a minimum grade of C- or CHNS 2301 with a minimum grade of C- or CHNS 1502 with a minimum grade of C-

### CHNS 2301. Intermediate Chinese Immersion 1. (4 Hours)

Designed for students who are in a Chinese-speaking country, this is an off-campus immersion course. Offers students an opportunity to continue to develop grammatical and conversational competence. Focuses on oral and aural skills that are enhanced by the immersion environment.

### CHNS 2302. Intermediate Chinese Immersion 2. (4 Hours)

Designed for students who are in a Chinese-speaking country, this is an off-campus immersion course. Offers students an opportunity to continue to develop grammatical and conversational competence. Focuses on oral and aural skills that are enhanced by the immersion environment.

### CHNS 2900. Specialized Instruction in Chinese. (1-4 Hours)

Focuses on developing students' language proficiency and cultural competence within a specific context. May be repeated twice for a maximum of 12 semester hours with department approval.

**Prerequisite(s):** CHNS 1102 with a minimum grade of C-

### CHNS 2990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHNS 3101. Advanced Chinese 1. (4 Hours)**

Stresses the fundamentals of Chinese to promote effective self-expression through speaking and writing and to explore the idiomatic aspects of the language. Through progressive class discussions and oral and written commentaries, students analyze a contemporary Chinese novel or a Chinese cultural reader, screenplay, or collection of short stories. The course strives, first, to help students read and comprehend modern Chinese writing with confidence and to be able to talk and write about it in good Chinese; and second, to provide preparation for advanced courses.

**Prerequisite(s):** CHNS 2102 with a minimum grade of D- or CHNS 2302 with a minimum grade of D-

**CHNS 3102. Advanced Chinese 2. (4 Hours)**

Continues CHNS 3101. Designed to enhance and reinforce the practical language and communication skills that students employ when they are abroad. Offers students an opportunity to participate in service-learning experiences.

**Prerequisite(s):** CHNS 3101 with a minimum grade of C- or CHNS 3301 with a minimum grade of C-

**CHNS 3301. Advanced Chinese Immersion 1. (4 Hours)**

Designed for students who are in a Chinese-speaking country, this is an off-campus immersion course. Offers students an opportunity to continue to develop grammatical and conversational competence.

**CHNS 3302. Advanced Chinese Immersion 2. (4 Hours)**

Designed for students who are in a Chinese-speaking country, this is an off-campus immersion course. Offers students an opportunity to continue to develop grammatical and conversational competence.

**CHNS 3800. Special Topics in Chinese. (1-4 Hours)**

Focuses on specific aspects of Chinese language and culture. May be repeated twice for a maximum of 12 semester hours, when topics vary.

**Prerequisite(s):** CHNS 3101 with a minimum grade of C-

**CHNS 3900. Specialized Instruction in Chinese. (1-4 Hours)**

Focuses on developing students' language proficiency and cultural competence within a specific context. May be repeated twice for a maximum of 12 semester hours with department approval.

**Prerequisite(s):** CHNS 2102 with a minimum grade of C-

**CHNS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHNS 4800. Special Topics in Chinese. (1-4 Hours)**

Focuses on specific aspects of Chinese language and culture for advanced Chinese-language learners. May be repeated twice for a maximum of 12 semester hours with department approval.

**Prerequisite(s):** CHNS 3102 with a minimum grade of C-

**CHNS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CHNS 4992. Directed Study. (1-4 Hours)**

Offers students a way of going beyond work given in the regular curriculum; may also enable students to complete major or minor requirements in certain situations. Priority is given to language majors and to juniors and seniors. May be repeated without limit.

**CHNS 5976. Directed Study. (1 Hour)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

## Civil and Environmental Engineering (CIVE)

### CIVE 1200. How Cities Work: Experiencing Urban Infrastructure. (4 Hours)

Explores the networks that underpin the very existence of cities: our urban infrastructure. Designed as a grand tour of the engineering marvels that exist beneath our feet but whose operation is critical to urban dwellers, using Boston as our guide. Offers students an opportunity to study a new infrastructure system, first by learning and discussing the engineering principles behind its design and operation, and then by experiencing our local infrastructure through visits to local operation centers, city officials, and private contractors that manage and maintain them. Topics include transportation, energy, telecommunications, water and wastewater, food processing and distribution, and waste management. Explores how our infrastructure is interconnected and how this leads both to resilience and to fragility in the face of natural and anthropogenic disruptions.

**Attribute(s):** NUpath Natural/Designed World

### CIVE 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### CIVE 2221. Statics and Solid Mechanics. (4 Hours)

Connects fundamentals of Newtonian physics to the stresses and deformations in solids. Introduces properties of areas and volumes (centroidal axes, moments of inertia); equilibrium of particles and rigid bodies in two and three dimensions; analysis of internal forces in trusses and simple frames; shear and moment diagrams in beams; computation of stresses induced by axial force, moment, shear, and torque; and mechanical properties of materials.

**Prerequisite(s):** (MATH 1342 with a minimum grade of D- ; (PHYS 1151 (may be taken concurrently) with a minimum grade of D- or PHYS 1161 (may be taken concurrently) with a minimum grade of D- )) or (PHYS 1141 (may be taken concurrently) with a minimum grade of D- ; MATH 1241 with a minimum grade of D- )

**Corequisite(s):** CIVE 2222

### CIVE 2222. Recitation for CIVE 2221. (0 Hours)

Accompanies CIVE 2221. Covers problem solving and topics related to the course.

**Corequisite(s):** CIVE 2221

### CIVE 2260. Materials for the Built Environment. (4 Hours)

Introduces the physical, mechanical, and chemical properties of materials of importance to civil engineers. Offers an overview of the ways in which these properties affect the material selection process, material behavior, and the design process.

**Prerequisite(s):** (CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1211 with a minimum grade of D- ); MATH 1342 with a minimum grade of D- ; (PHYS 1151 with a minimum grade of D- or PHYS 1161 with a minimum grade of D- )

**Corequisite(s):** CIVE 2261

### CIVE 2261. Lab for CIVE 2260. (1 Hour)

Involves the use of standard lab test methods and equipment to determine properties of materials common to civil engineering practice. Also introduces students to land surveying, site layout, and the measurement of distance, elevation, and direction.

**Corequisite(s):** CIVE 2260

**Attribute(s):** NUpath Analyzing/Using Data

### CIVE 2300. Environmental Measurements in Natural and Engineered Systems. (2 Hours)

Presents the theory and application of field and laboratory methods for measurement of water and air quality parameters, soil properties, and environmental processes. Introduces the complexities and challenges associated with characterization and measurements of environmental processes in natural and engineered systems. Emphasizes data analysis, report writing, development of problem-solving skills, and teamwork using real-life laboratory and field experiments and class projects.

**Prerequisite(s):** CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1211 with a minimum grade of D-

**Corequisite(s):** CIVE 2301

### CIVE 2301. Lab for CIVE 2300. (2 Hours)

Accompanies CIVE 2300. Covers topics from that course through various experiments. Includes a project.

**Corequisite(s):** CIVE 2300

**CIVE 2320. Structural Analysis. (4 Hours)**

Connects fundamentals from CIVE 2221 to analyze stresses, strains, strength, forces, and displacements in regular structures and structural members such as trusses, beams, frames, and arches. Covers shear stresses in beams; combined stress analysis (bars with axial load plus shear and bending); introduction to buckling; influence lines (application to statically determinate systems); computation of deflections (statically determinate systems); and analysis of indeterminate structures using virtual work and the flexibility method. Introduces applications to sensing and monitoring of civil structures using the flexibility method and moment distribution.

**Prerequisite(s):** CIVE 2221 with a minimum grade of D-

**Corequisite(s):** CIVE 2321

**CIVE 2321. Recitation for CIVE 2320. (0 Hours)**

Accompanies CIVE 2320. Covers problem solving and topics related to the course.

**Corequisite(s):** CIVE 2320

**CIVE 2324. Concrete Structure Design. (4 Hours)**

Presents the mechanical properties of concrete and steel reinforcement. Discusses the design of reinforced concrete structures for various loading conditions and covers the design of common reinforced concrete structural elements. Examines behavior and design of reinforced concrete beams, one-way slab systems, footings, and short columns based on latest ACI-318 code.

**Prerequisite(s):** CIVE 2221 with a minimum grade of D-

**CIVE 2331. Fluid Mechanics and Hydraulics. (4 Hours)**

Introduces the principles of fluid mechanics and the applications in basic hydraulic engineering systems. Topics include properties of fluids; pressure and force on surfaces and submerged bodies; continuity, momentum, and energy conservation principles; dimensional analysis and hydraulic similitude; flow in closed conduits; steady flow in pipe networks; unsteady flow in pipes; flow in open channels; hydraulic machines; and hydraulic structures. The laboratory component includes demonstrations and experiments to show the applicability of fluid mechanics and hydraulics principles.

**Prerequisite(s):** CIVE 2221 with a minimum grade of D-

**CIVE 2334. Environmental Engineering: Principles, Technology, and Sustainability. (4 Hours)**

Focuses on the protection and management of the environment and the engineering methods to control environmental quality problems. Topics include assessment of environmental quality, introduction to water and wastewater treatment technologies, air pollution control technologies, solid waste management, and global atmospheric change.

**Prerequisite(s):** CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1211 with a minimum grade of D-

**CIVE 2335. Environmental Engineering Chemistry. (4 Hours)**

Covers chemistry principles required for describing chemical processing of elements in natural systems, the distribution of pollutants in the environment, and chemical use in engineered treatment systems. Focuses on equilibrium thermodynamics and equilibria for acid-base, gas-water, precipitation-dissolution, metal complexation, oxidation-reduction, and sorption reactions. Discusses specific applications to pollutant reactions in surface waters, ground waters, soils, drinking water treatment, wastewater treatment, and the atmosphere.

**Prerequisite(s):** CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1211 with a minimum grade of D-

**CIVE 2340. Geotechnical Engineering. (4 Hours)**

Focuses on the formation, composition, and classification of soil for engineering purposes; soil-water phase relations; water in soil; seepage; stresses in soil; consolidation theory; strength properties of soils; and the basics of geoenvironmental engineering.

**Prerequisite(s):** CIVE 2221 with a minimum grade of D- or CIVE 2260 with a minimum grade of D-

**Corequisite(s):** CIVE 2341

**CIVE 2341. Lab for CIVE 2340. (1 Hour)**

Accompanies CIVE 2340. Introduces standard laboratory procedures for characterizing the physical, hydraulic, and mechanical properties of soils as well as data reduction and analysis methods for various test methods. Laboratory methods and determinations include moisture content, Atterberg limits, permeability, compaction, consolidation, and direct shear. Includes the use of computer-based data acquisition systems and measurement transducers.

**Corequisite(s):** CIVE 2340

**CIVE 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CIVE 2992. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors. May be repeated up to nine times.

**CIVE 3335. Environmental Engineering Chemistry and Chemical Technologies. (4 Hours)**

Covers chemistry principles required for describing chemical processing of elements in natural systems, distribution of pollutants in the environment, and chemical use in engineered treatment systems. Focuses on equilibria and reaction kinetics for acid-base, gas-water, precipitation-dissolution, metal complexation, oxidation-reduction, and sorption reactions. Discusses specific applications to pollutant reactions in surface waters, ground waters, soils, drinking water treatment, wastewater treatment, and the atmosphere. Performs laboratory demonstrations and design of chemical treatment technologies for water quality improvement.

**Prerequisite(s):** CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1211 with a minimum grade of D-

**CIVE 3425. Steel Structure Design. (4 Hours)**

Presents the design of steel structures for various loading conditions, including design of different types of frame structures that include steel members subjected to tension, compression, bending, and combinations of loading, and design of connections. Establishes the fundamentals of the behavior and the principles of creative design of steel structures using the latest load and resistance factor design (LRFD) specification of the American Institute for Steel Construction.

**Prerequisite(s):** CIVE 2320 with a minimum grade of D-

**CIVE 3430. Engineering Microbiology and Ecology. (4 Hours)**

Introduces the importance of microorganisms and plants to the natural and built environments and evidence-based decision making for complex systems constrained and defined by multiple metrics. Seeks to provide a fundamental understanding of microorganisms (metabolisms, growth, genetics, resource requirements, and niche) and their role in the global ecosystem (element cycling, energy flows, food webs). Examines the role of plants and microbes in both engineered and natural environmental systems and bidirectional interactions between the natural and the built environments. Framed around a series of case studies that highlight the challenges of and strategies for engineering in the earth system context, such as microbially mediated infrastructure corrosion; ecological effects of nutrient pollution; bioaccumulation; green infrastructure and remediation (constructed wetlands, bioremediation); and wastewater treatment.

**Prerequisite(s):** CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1211 with a minimum grade of D-

**CIVE 3435. Environmental Pollution: Fate and Transport. (4 Hours)**

Provides a systematic approach to analyzing the fate and transport of pollutants within natural systems. Equilibrium modeling and reactive transport modeling are used to assess the predominant processes that control the movement and persistence of pollutants in water, soil, and air. Topics include mass transfer across multiple phases; physical, chemical, and biological transformations of substances; transport processes (diffusion, dispersion, advection, interphase mass transport); eutrophication of lakes; conventional pollutants in rivers and estuaries; groundwater contamination; and atmospheric deposition.

**Prerequisite(s):** CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1214 with a minimum grade of D-

**CIVE 3464. Probability and Engineering Economy for Civil Engineering. (4 Hours)**

Introduces engineering probability and statistics, as well as engineering economic analysis for project or design evaluation. Case studies are used to illustrate the integration of these areas in the design/system analysis process. Topics in engineering probability and statistics include descriptive statistics, expected value of random variables, and hypotheses testing. Statistical process control and sampling methods are introduced. Reliability methods for the analysis and improvement of system/design performance are discussed. Also covers fundamental concepts of time value of money and economic evaluation of alternatives, including the effects of depreciation and taxes.

**Prerequisite(s):** MATH 2321 with a minimum grade of D-

**CIVE 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CIVE 4534. Water Treatment Systems Design. (3 Hours)**

Continues CIVE 2334. Concentrates on unit operations; unit processes; and related fundamental design of physical, chemical, and biological water and wastewater treatment systems, using both lectures and laboratory instruction. Topics include aeration systems, activated sludge, fixed-film biological treatment, gas transfer, reaction kinetics, reactor modeling, coagulation, flocculation, sedimentation, filtration, and subsurface disposal system design. Includes project component.

**Prerequisite(s):** (CIVE 2331 with a minimum grade of D- or CHME 2310 with a minimum grade of D- ); CIVE 2334 with a minimum grade of D-

**Corequisite(s):** CIVE 4535

**CIVE 4535. Lab for CIVE 4534. (1 Hour)**

Accompanies CIVE 4534. Covers topics from the course through various experiments.

**Corequisite(s):** CIVE 4534

**CIVE 4540. Resource Recovery and Waste Treatment Technologies Abroad. (4 Hours)**

Examines different aspects relative to municipal and industrial solid waste, with a special focus on material recovery. Covers chemical-physical characterization of waste, source reduction and toxicity, recycling and selection of different fractions, resource and energy recovery (e.g., composting, anaerobic digestion, combustion to energy), and analysis and preliminary design of treatment disposal options. Through design projects, offers students an opportunity to apply lessons learned to the U.S. context. Taught in a study-abroad format in a European nation.

**CIVE 4541. Waste Management and Policy Abroad. (4 Hours)**

Explores how the country visited manages the recovery and treatment of both industrial and municipal solid waste. Emphasizes waste generated in mining and other industrial activities (e.g., refinery, military). Examines multifaceted aspects, including governance; science/engineering; and health, social, and policy. Offers students an opportunity to interact with local experts and to visit key sights. Encourages students to think about possible policy lessons for the United States. Taught abroad.

**CIVE 4542. Foundation Engineering and Design. (4 Hours)**

Focuses on subsurface field investigation, soil-bearing capacity determination, settlement estimation, design of shallow foundations and pile foundations, and design of retaining walls. Includes project component.

**Prerequisite(s):** CIVE 2340 with a minimum grade of D- ; (ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**CIVE 4554. Highway Design. (4 Hours)**

Concentrates on highway design including route selection, geometric design, foundation and pavement design, drainage design, and construction issues. Analyzes highway traffic including traffic flow fundamentals and capacity and level of service analysis for freeways and rural highways. Covers the environmental impact and public review process for highway construction. Includes project component.

**Prerequisite(s):** CIVE 2261 with a minimum grade of D- ; (ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**CIVE 4566. Design for Sustainable Transportation: Netherlands. (4 Hours)**

Examines how the design of Dutch transportation infrastructure promotes travel by foot, bicycle, and public transportation as opposed to private automobile and how it promotes urban livability and traffic safety. Topics include bicycling infrastructure planning and design; Vision Zero traffic safety principles and design treatments for safe roads, intersections, and crossings; and high-quality transit service planning and design. Through design projects, offers students an opportunity to apply lessons learned to the U.S. context. Taught in a study-abroad format in the Netherlands.

**CIVE 4567. Planning and Policy for Sustainable Urban Transportation: Netherlands. (4 Hours)**

Examines urban transportation planning practices and policies in the Netherlands that promote travel by bicycling, public transportation, and foot and help prevent urban mobility from degrading urban livability. Topics include land-use planning at the site, neighborhood, and regional scale; transit- and bicycle-oriented development, including both land-use and transportation infrastructure planning and policies for large-scale urban expansions; and traffic-circulation planning and policies to promote safety, prevent roads from becoming barriers to walking, cycling, or transit, and to create car-free and car-lite zones. Taught in study-abroad format in the Netherlands.

**CIVE 4575. Construction Management. (3 Hours)**

Surveys the construction industry and tasks that must be addressed by construction management including resource allocation, construction environment, organization, contracts, funding, cash flow, productivity, conceptual and detailed cost estimating, labor relations, network planning and scheduling, construction accounting, and project control.

**CIVE 4765. Senior Design Project—Environmental. (5 Hours)**

Using teams, students design a civil engineering project that primarily involves the environmental subdiscipline. Design teams are advised by a faculty member and engineering practitioners. Lectures cover supplemental technical background specific to the project, as well as cross-disciplinary aspects of project development, value engineering, aesthetics, and constructability. Integrates project design with further development of student communications skills; students present the design to practicing engineers and interested parties such as community groups.

**Prerequisite(s):** (CIVE 5536 with a minimum grade of D- or CIVE 4534 with a minimum grade of D-); (ENGW 3301 with a minimum grade of C or ENGW 3302 with a minimum grade of C or ENGW 3315 with a minimum grade of C or ENGL 3301 with a minimum grade of C or ENGL 3302 with a minimum grade of C or ENGL 3315 with a minimum grade of C)

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov, NUpath Writing Intensive

**CIVE 4767. Senior Design Project—Structural. (5 Hours)**

Using teams, students design a civil engineering project that primarily involves the structural subdiscipline. Design teams are advised by a faculty member and engineering practitioners. Lectures cover supplemental technical background specific to the project, as well as cross-disciplinary aspects of project development, value engineering, aesthetics, and constructability. Integrates project design with further development of student communications skills; students present the design to practicing engineers and interested parties such as community groups.

**Prerequisite(s):** (((CIVE 2324 with a minimum grade of D- ; CIVE 3425 with a minimum grade of D- ) or (CIVE 2324 with a minimum grade of D- ; CIVE 5522 with a minimum grade of D- ) or (CIVE 3425 with a minimum grade of D- ; CIVE 5522 with a minimum grade of D- )) or ((CIVE 2324 with a minimum grade of D- or CIVE 3425 with a minimum grade of D- ); CIVE 4542 with a minimum grade of D- ; CS 3000 with a minimum grade of D- )); (ENGL 3301 with a minimum grade of C or ENGL 3302 with a minimum grade of C or ENGW 3301 with a minimum grade of C or ENGW 3302 with a minimum grade of C or ENGW 3315 with a minimum grade of C )

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov, NUpath Writing Intensive

**CIVE 4768. Senior Design Project—Transportation. (5 Hours)**

Using teams, students design a civil engineering project that primarily involves the transportation subdiscipline. Design teams are advised by a faculty member and engineering practitioners. Lectures cover supplemental technical background specific to the project, as well as cross-disciplinary aspects of project development, value engineering, aesthetics, and constructability. Integrates project design with further development of student communications skills; students present the design to practicing engineers and interested parties such as community groups.

**Prerequisite(s):** CIVE 4554 with a minimum grade of D- ; (ENGL 3301 with a minimum grade of C or ENGW 3301 with a minimum grade of C or ENGL 3302 with a minimum grade of C or ENGW 3302 with a minimum grade of C or ENGW 3315 with a minimum grade of C ); (CIVE 5373 with a minimum grade of D- or CIVE 5376 with a minimum grade of D- or CS 3000 with a minimum grade of D- )

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov, NUpath Writing Intensive

**CIVE 4777. Climate Hazards and Resilient Cities Abroad. (4 Hours)**

Focuses on the science of “global weirding”—unprecedented changes in weather caused by global warming and natural climate variability. Introduces the physical-science basis of climate, computer models of the earth system, statistical tools for the analysis of climate model, and remote sensor data. Also introduces the concept of urban resilience, focusing on preventing natural hazards from turning into catastrophic disasters in densely populated and vulnerable regions. Examines multifaceted aspects of resilience, including governance, emergency response, infrastructural, informational, social, and policy aspects. Encourages students to consider the science, engineering, and policy challenges in transforming vulnerable urban and coastal regions to climate-resilient cities and to examine how societies can learn from each other by comparing Boston with the country visited. Taught abroad.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**CIVE 4778. Climate Adaptation and Policy Abroad. (4 Hours)**

Explores how the country visited plans to adapt to climate change and natural hazards and how that country participates in international climate and emissions negotiations, within the context of its history and culture. Focuses on how an emerging economy adjusts to the reality of climate change/extremes and how citizens may drive decisions and policy. Incorporates topics from climate change, environmental sciences, civil and chemical engineering, remote sensing, social sciences, electrical engineering, computer science, and the management sciences. Encourages students to think about possible policy lessons for the United States. Offers students an opportunity to visit key sights. Culminates with a mock “climate change war game,” simulating an event in which international negotiators meet to formulate treaties on climate change adaptation and mitigation. Taught abroad.

**Attribute(s):** NUpath Natural/Designed World

**CIVE 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated without limit.

**CIVE 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** CIVE 4970 with a minimum grade of D-

**CIVE 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CIVE 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated two times.

**Attribute(s):** NUpath Integration Experience

**CIVE 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**CIVE 5100. Equity in Engineering. (4 Hours)**

Explores how problems that are commonly defined in technical terms can be deeply socially embedded. Using case studies, evaluates how engineering solutions and policies can disproportionately affect people's exposure to harms. Topics include environmental justice, community-based approaches, and the social environment. Offers students an opportunity to enhance their understanding of potential engineering impacts on communities and improve their ability to work with diverse groups.

**CIVE 5150. Climate and Atmospheric Change. (4 Hours)**

Offers an in-depth view of the processes that drive change in Earth's climate system. Examines the modern climate system and how and why climate changes through time. Introduces the tools used to explore past climates and changes, and explores the long-term and short-term controls on the climate system. Also introduces the application of climate models to develop future climate projections. Offers students an opportunity to obtain hands-on experience analyzing and interpreting climate data and model output.

**Prerequisite(s):** ENVR 1200 with a minimum grade of D- or ENVR 2200 with a minimum grade of D- or (PHYS 1151 with a minimum grade of D- ; PHYS 1152 with a minimum grade of D- ; PHYS 1153 with a minimum grade of D- ) or graduate program admission

**CIVE 5221. Construction Project Control and Organization. (2 Hours)**

Overviews the organization of construction firms at the general corporate level and the project level. Covers cost, schedule, budget, and financial control of projects. Also examines the flow of information between parties to the project.

**Prerequisite(s):** CIVE 4575 with a minimum grade of D- or CIVE 7220 with a minimum grade of C-

**CIVE 5231. Alternative Project Delivery Systems in Construction. (2 Hours)**

Offers a comprehensive overview of alternative construction project delivery systems in the public and private sectors; project life cycle including project development, schedule, cost and risk management, quality assurance/quality control, project management, and project closeout; innovative financing strategies including contractor financing, franchises, and super turnkey. Focuses on the analysis of design/bid/build execution compared to design/build and construction management systems of delivery. Examines international projects, contracts, and partnering options—for example JVs and alliances—as vehicles to ensure the meeting of project objectives. Uses case studies to identify and practice the management skills required for successful D/B project execution including effective communication, negotiations, and team building.

**Prerequisite(s):** CIVE 4575 with a minimum grade of D- or CIVE 7220 with a minimum grade of C-

**CIVE 5232. Leading and Constructing Global Megaprojects. (2 Hours)**

Studies global trends in managing megaprojects; distinctions between managing megaprojects and smaller construction projects; and strategic planning, governance, financing mechanisms, leadership dynamics, and project delivery methods specifically tailored for mega-construction projects.

**Prerequisite(s):** CIVE 4575 with a minimum grade of D- or graduate program admission

**CIVE 5250. Organic Pollutants in the Environment. (4 Hours)**

Introduces principles that govern the fate and transport of organic chemicals released to the environment. Topics include chemical structure and thermodynamic properties and how they predict physical processes that control the distribution of contaminants between the atmosphere, fresh and marine surface waters, groundwater, soils, sediments, and biota. Introduces models and methods for predicting fate and transport of organic contaminants within and between environmental media, including molecular diffusion, transport across boundaries, and box models. Explores concepts linking environmental chemistry with ecotoxicology, including bioaccumulation, food web models, and risk assessment. Uses case studies and real-world scenarios to illustrate concepts.

**Prerequisite(s):** CHEM 1151 with a minimum grade of D- or CHEM 1211 with a minimum grade of D- or graduate program admission

**CIVE 5255. Tools and Techniques of Environmental Health. (4 Hours)**

Introduces basic concepts of environmental health sciences, methods used to study the interface of health and the environment, the health impacts of various environmental processes and exposures, and public health approaches to controlling or eliminating environmental health risks. Covers basic environmental health principles, such as exposure assessment, environmental toxicology, environmental epidemiology, and risk assessment. Also covers specific environmental health issues including toxic exposures from chemicals used in plastics, food production, and everyday household products; water and air pollution; climate change; and other environmental drivers of disease.

**CIVE 5260. Environmental Fluid Mechanics. (4 Hours)**

Focuses on fundamentals of fluid mechanics, but with application to the natural and built environment based on transport and dispersion phenomena. Reviews theory necessary for an understanding of environmental fluid flows and methods of observation, including acoustic Doppler current profiles, profiling towers, and modeling, including large eddy simulation (LES).

**CIVE 5261. Dynamic Modeling for Environmental Investment and Policymaking. (4 Hours)**

Introduces the theory, methods, and tools of dynamic modeling for policy and investment decision making, emphasizing environmental issues. Makes use of state-of-the-art computing methods to translate theory and concepts into executable models and offers extensive hands-on modeling experience. Topics include management of discrete flows (e.g., models of traffic systems); discounting, intertemporal optimization (e.g., models of resource extraction); dynamic games (e.g., models for adaptive management); and treatment of risk, uncertainty, novelty, and complexity (e.g., for investment and policymaking).

**CIVE 5271. Solid and Hazardous Waste Management. (4 Hours)**

Introduce various aspects of integrated solid waste management system and hazardous waste management practices. Includes both engineering principles as well as socioeconomic and regulatory issues surrounding solid and hazardous waste management. Provides sufficient background to enable the student to understand, evaluate, and critique the design of and the decisions in various waste management alternatives.

**CIVE 5275. Life Cycle Assessment of Materials, Products, and Infrastructure. (4 Hours)**

Explores the conceptual and mathematical foundations of life cycle assessment (LCA), a widely used systems-modeling method for quantifying emissions and assessing the environmental and health impacts of products and processes. Covers engineering models of industrial material and energy use and emissions, as well as environmental science models of fate and transport, exposure, and toxicology. Examines Monte Carlo simulation, structural path analysis, and model sensitivity analysis for industrial network structures underlying LCA modeling. Introduces open-source LCA data and software and their application to real-world industry and policy analyses.

**Prerequisite(s):** CIVE 3464 with a minimum grade of D- or graduate program admission

**CIVE 5280. Remote Sensing of the Environment. (4 Hours)**

Introduces remote sensing techniques, including obtaining, visualizing, and analyzing satellite data. Examines physical processes, methods, and data products used in satellite remote sensing of the Earth's environment. Topics include active and passive remote sensing methods based on fundamentals of electromagnetic radiation, concepts used to develop data products from the remotely sensed measurements, and a suite of satellite data products to investigate current and past conditions of the Earth's terrestrial and ocean surfaces. Uses geographic information systems (GIS) and student-developed programs to view and interpret satellite data. Knowledge of GIS, R, and Python is preferred.

**CIVE 5281. Coastal Dynamics and Design. (4 Hours)**

Introduces the basic theory of the forcing and response of the built and natural coastal environment, including hurricanes and extratropical storms, wind waves, astronomical tides, storm surges, currents, fluid-structure interactions, sediment transport, and morphological changes. Seeks to provide an overview of the physical processes and the functional design of coastal works, including anthropogenic and natural and nature-based features. Uses examples and case studies to illustrate the theory and the interdependence of water motion and coastal morphology. Emphasizes the challenges of extreme events and natural hazards in the coastal environment. Requires prior completion of one semester of fluid mechanics or equivalent.

**Prerequisite(s):** CIVE 2331 with a minimum grade of D- or EEMB 3120 with a minimum grade of D- or graduate program admission

**CIVE 5300. Environmental Sampling and Analysis. (2 Hours)**

Introduces the theory, application, methodology, and instrumentation used in planning, sampling, and analyzing the environmental contaminants in air, water, and soils. Emphasizes instrument selection and quality control, including documentation, calibration, data analysis and interpretation, and sample management.

**Prerequisite(s):** CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1211 with a minimum grade of D- or graduate program admission

**Corequisite(s):** CIVE 5301

**CIVE 5301. Lab for CIVE 5300. (2 Hours)**

Accompanies CIVE 5300. Covers topics from the course through various experiments. Includes a team project.

**Corequisite(s):** CIVE 5300

**CIVE 5363. Climate Science, Engineering Adaptation, and Policy. (4 Hours)**

Offers an evidence-based glimpse of what has been called a clear and present danger to mankind. Analyzes case studies from the magic of the butterfly effect in chaos theory to the deep challenges in physics, biogeochemistry, and data sciences. Covers topics from experimental design to satellite-based remote sensing, all the way to the design and operations of next-generation hydraulic infrastructures, transportation systems, smart grids, and communication networks, including the impacts on coastal or inland cities, the resilience to weather hazards, and the sustainability of water-energy-food resources. Includes policy issues and risk-informed trade-offs in renewable energy, environmental regulations, and emissions control. Graduate students are required to complete a mandatory class project.

**CIVE 5365. Climate Technologies for Decarbonization, Mitigation, and Adaptation. (4 Hours)**

Presents the major engineering technologies and large-scale infrastructure changes needed to address global climate change. Examines multiple strategies for proposed engineering solutions, including mitigation of emissions (demand reduction and decarbonization), adaptation to climate change, carbon capture and storage (negative emissions), and geoengineering. Covers engineering and design fundamentals, technical feasibility for scale-up, and economic implications, informed by cutting-edge scientific and technical reports for each technology. Concludes with a holistic consideration of engineering costs, speed, effectiveness, and ethics in prioritizing investments in climate technologies.

**CIVE 5366. Air Quality Engineering and Science. (4 Hours)**

Introduces the fundamentals of atmospheric composition; their sources, properties, and chemistry in the atmosphere; and their effects on human health and the environment. Covers the history of the discovery of chemicals, the evolution of the earth's atmosphere, and the structure and composition of the present-day atmosphere. Discusses science of major air pollution issues on an urban through global scale, including urban outdoor air pollution, indoor air pollution, acid deposition, stratospheric ozone depletion, air pollution transport across political boundaries, and global climate change, as well as energy solutions to air pollution and global warming.

**CIVE 5368. Air Quality Management. (4 Hours)**

Explores engineering theory and practice related to air resources management. Focuses on modeling dispersion and reactions for atmospheric pollutants and on analysis of systems for controlling gaseous and particulate emissions including dry collection, wet collection, absorption, and catalytic processes. Also addresses biological and chemical aspects of air pollution including toxicological issues, physiological effects of aerosols, analysis of organic and inorganic constituents of the atmosphere, and rationale for establishing air quality criteria and standards. Requires one semester of undergraduate chemistry.

**Prerequisite(s):** CIVE 2334 with a minimum grade of D- or graduate program admission

**CIVE 5369. Atmospheric Boundary Layer Flows. (4 Hours)**

Covers the fundamentals of atmospheric boundary layer turbulence; its dependence on surface properties; and its relevance for environmental engineering, hydrology, and climate change. Introduces the concepts of Reynolds decomposition into mean flow and turbulence statistics. Delves into similarity theories and surface exchange schemes, turbulence closure models, thermal stratification effects, and spectral properties of turbulence. Focuses on the distinct behavior of airflow in the ABL as a function of height above the surface and measurement methods and numerical simulations, including the eddy covariance technique and large eddy simulation.

**Prerequisite(s):** (CIVE 2331 with a minimum grade of D- ; MATH 2321 with a minimum grade of D- ; PHYS 1161 with a minimum grade of D- ) or graduate program admission

**CIVE 5373. Transportation Systems: Analysis and Planning. (4 Hours)**

Discusses urban transportation planning and engineering for modes other than highway. Covers travel demand forecasting for both the short and long term including impact analysis methods, simple elasticity models, and the four-step model system of trip generation, trip distribution, modal split, and network assignment. Introduces transit service analysis and design. Other topics include capacity, service, and engineering design basics for different travel modes, such as bus, airport, rail, and bicycle. Considers the environmental impact, economic evaluation, and financial impact of different modes of transportation.

**CIVE 5376. Traffic Engineering and Sustainable Urban Street Design. (4 Hours)**

Covers street and intersection design for meeting societal needs related to traffic capacity, level of service, safety, walkability, bikeability, and the quality of public space. Intersection analysis and design topics include traffic flow theory and measurement; capacity; queuing and delay for both vehicles and pedestrians; and signal timing plan design, including design for pedestrian crossings. Street design topics include street functions; speed control; street and intersection layout; bicycling facilities, including bike lanes and separated bike paths; and pedestrian facilities, including sidewalks and crossings. Offers students an opportunity to practice with standard design manuals and intersection analysis software.

**CIVE 5520. Structural Systems. (4 Hours)**

Covers the design of structural systems. Includes the major aspects of structural behavior and design (loads, load paths, structural system concepts, analysis, member and connection design, and structural detailing). Discusses typical structural building materials along with a brief introduction to less conventional materials. Emphasizes wood and masonry design. Also presents structural principles behind some innovative structural systems. Utilizes current professional practice with a focus on approximate hand methods of structural analysis. Requires one semester of undergraduate structural analysis.

**Prerequisite(s):** CIVE 2320 with a minimum grade of D- or graduate program admission

**CIVE 5522. Structural Systems Modeling. (4 Hours)**

Continues CIVE 2320. Covers analysis of indeterminate structural systems using matrix methods. Studies how to implement matrix analysis of indeterminate structures using both flexibility and stiffness approaches. Serves as an introduction to the finite element method.

**Prerequisite(s):** (CIVE 2320 with a minimum grade of D- ; MATH 2341 with a minimum grade of D- ) or graduate program admission

**CIVE 5524. Vibration-Based Structural Health Monitoring. (4 Hours)**

Explores the theory and implementation of modern techniques for monitoring the health of structural systems using vibration signals. Includes an introduction to system identification, finite element model updating, novelty-based change detection, and techniques for the localization and quantification of damage induced by extreme events or progressive deterioration.

**Prerequisite(s):** (CIVE 2320 with a minimum grade of D- ; MATH 2341 with a minimum grade of D- ) or graduate program admission

**CIVE 5525. Prestressed Concrete Design. (4 Hours)**

Introduces analysis and flexural design of prestressed concrete members, allowable stress in concrete and steel, pre- and posttensioned concrete beams, strength evaluation, and prestressed concrete bridge design. Requires one semester of undergraduate concrete design or one semester of undergraduate structural analysis.

**Prerequisite(s):** CIVE 2320 with a minimum grade of D- ; CIVE 2324 with a minimum grade of D- or graduate program admission

**CIVE 5527. Sustainable Rehabilitation of Structures. (4 Hours)**

Explores the benefits of reusing existing structures to mitigate increased CO<sub>2</sub>e production, freshwater use, and demolition waste associated with new construction. Examines tools used to evaluate existing buildings and materials, including the concept of embodied carbon and structural investigation and condition assessments. Focuses on the repair, rehabilitation, and retrofit requirements based on review of existing drawings, historical building codes and references, and modern building codes. Discusses classifying project scope, working within project constraints, and the building industry's response to climate change. Includes aspects of structural behavior and strengthening such as new and existing loads, connections and detailing, the use of modern and salvaged materials, and designing for resiliency.

**Prerequisite(s):** (CIVE 2324 with a minimum grade of D- or CIVE 3425 with a minimum grade of D-) or graduate program admission

**CIVE 5528. Resilient Structural Infrastructure. (4 Hours)**

Challenges from the impact of our changing climate on our infrastructure from two angles: extending the useful life of our existing systems through structural modifications and making forward-thinking structural engineering design decisions. Assesses the performance of the built environment during disasters such as flooding, seismic events, and wind events to reduce recovery effects and costs. Focuses on the structural framework supporting our built environment in addition to considerations for the lifelines keeping our cities operational.

**Prerequisite(s):** (CIVE 2324 with a minimum grade of D- or CIVE 3425 with a minimum grade of D-) or graduate program admission

**CIVE 5536. Hydrologic and Hydraulic Design. (4 Hours)**

Introduces principles of engineering hydrology. Covers the hydrologic cycle, rainfall and flood frequency analysis, rainfall intensity-duration-frequency relationships, rainfall-runoff processes, hydrologic flood routing, and culvert/channel hydraulics. Utilizes these concepts in design applications of civil infrastructure such as stormwater detention basins, drainage pipes, culverts, etc. Uses hydrologic and hydraulic modeling software such as HEC-HMS and HEC-RAS. Includes project component.

**Prerequisite(s):** (CIVE 2331 with a minimum grade of D- ; (ENGL 1111 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1102 with a minimum grade of C)) or graduate program admission

**Attribute(s):** NUpath Writing Intensive

**CIVE 5670. Global Biogeochemistry. (4 Hours)**

Examines the biological, chemical, and physical interactions that shape our global environment. These interactions combine in the global biogeochemical cycles. Industrial emission of gases, use of fertilizers and plastics, and the expansion of cities are altering the biogeochemical cycling of the elements carbon, nitrogen, and phosphorus at rates unprecedented in the geological record. Uses lectures and the latest update to Chapter 6, "Carbon and Other Biogeochemical Cycles," of the International Panel on Climate Change report to explore the main interactions between human activity, biogeochemical change, and climate. Discusses primary literature to delve deeper into these interactions.

**Attribute(s):** NUpath Natural/Designed World

**CIVE 5699. Special Topics in Civil Engineering. (1-4 Hours)**

Offered when the need for a special topic is evident to faculty and students. Topics are initiated by appropriate faculty members and discipline committee and approved by the department. May be repeated up to two times for up to 12 total credits.

**CIVE 5984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**CIVE 6566. Sustainable Urban Transportation: Netherlands. (4 Hours)**

Examines how Dutch communities and their transportation systems are planned and designed to promote ABC (all-but-car) transportation, traffic safety, and livability. Topics include design of urban bicycling infrastructure for the mainstream population; planning and service design for high-quality public transportation; urban planning in support of transit, bicycle, and foot transportation, including both suburban development and urban redevelopment; and Vision Zero/Systematic Safety policy and design for traffic safety and its application to urban areas. Taught in study-abroad format in the Netherlands.

**CIVE 6777. Climate Hazards and Resilient Cities Abroad. (4 Hours)**

Combines the science, engineering, economic, social, and policy aspects of how cities can prepare themselves for climate change and natural hazards. Focuses on the science of unprecedented changes in weather caused by global warming and natural climate variability. Introduces the physical-science basis of climate, computer models and statistical tools, and remote sensor data. Introduces the concept of urban resilience, focusing on preventing natural hazards from turning into catastrophic disasters in densely populated regions. Examines resilience, including governance, emergency response, infrastructural, informational, social, and policy aspects. Encourages students to consider the science, engineering, and policy challenges in transforming vulnerable urban and coastal regions to climate-resilient cities and to examine how societies can learn from each other by comparing Boston with the country visited. Taught abroad.

**CIVE 6778. Climate Adaptation and Policy Abroad. (4 Hours)**

Explores how the country visited plans to adapt to climate change and natural hazards and how it chooses to participate in international climate and emissions negotiations. Focuses on how an emerging economy adjusts to the reality of climate change/extremes and how the will of citizens may drive decisions and policy. Incorporates topics from climate change, environmental sciences, civil and chemical engineering, remote sensing, social sciences, electrical engineering, computer science, and the management sciences. Encourages students to think about possible policy lessons for the United States. Culminates with a mock climate change war game, simulating an event in which international negotiators meet to formulate treaties on climate change adaptation and mitigation. Taught abroad.

**CIVE 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CIVE 7001. Research Methods For Civil and Environmental Engineering. (2 Hours)**

Introduces incoming research-oriented graduate students in civil and environmental engineering to best practices and useful tools and techniques in conducting and communicating scientific research. Course topics include reviewing and summarizing literature, proposal writing, planning and conducting research, scientific writing and communication, and careers in research. Class sessions mix short lectures (from course instructors and guests), class discussions, and peer- and group-based activities. Offers instruction about effective research practices across the broad field of civil and environmental engineering to lay the groundwork for successful research experiences at Northeastern and in students' future careers.

**CIVE 7002. Programming and Data Science for Civil and Environmental Engineering. (2 Hours)**

Introduces research-oriented graduate students in civil and environmental engineering to best practices and useful tools and techniques in computer programming and data science across the discipline. Course topics include basic programming, data acquisition and management, design of experiments and common statistical tests, and data visualization and figure design. Class sessions will be a mix of short lectures (from course instructors and guests), class discussions, and peer- and group-based activities. Offers instruction in effective data science practices across the broad field of civil and environmental engineering to lay the groundwork for successful research experiences at Northeastern and in students' future careers.

**CIVE 7100. Time Series and Geospatial Data Sciences. (4 Hours)**

Offers an interdisciplinary course covering the fundamentals of time series and spatial statistics with applications in engineering, science, and business. Introduces analysis and forecasting methods for time series, spatial, and spatiotemporal data. Discusses classical time or frequency domain methods, as well as recent techniques motivated from computer science, physics, statistics, or engineering. Case studies relate to ongoing research and to real-world examples. A demo project is selected by the instructor based on discussion with individual students. A computer-based final project can be tailored to student interests in environmental engineering, sustainability sciences, security threat assessments, social sciences, business, or management science and finance. Requires undergraduate probability and statistics (CIVE 3464 or equivalent); background in programming languages such as MATLAB or R helpful but not required.

**CIVE 7110. Critical Infrastructure Resilience. (4 Hours)**

Introduces the concept of resilience by exploring engineering concepts and perspectives to offer students an opportunity to develop the ability to be prepared for and adapt to challenging situations and scenarios—e.g., globalization, climate change, security threats, and natural disasters—on critical infrastructures and key resources. Topics include application of tools for infrastructure modeling and risk assessment; identification of natural and man-made hazards; management of disaster risks and communications; resilience design; and future challenges, policy, and novel approaches to advance resilience. Explores application to real-life examples through group projects. Requires one semester of undergraduate statistics.

**CIVE 7150. Data-Driven Decision Support for Civil and Environmental Engineering. (4 Hours)**

Presents supervised and unsupervised methods for dealing with large data sets and their application to support decision making in various civil and environmental engineering areas. Focuses on predictive models and methods for knowledge mining. Discusses applications from the transportation, urban mobility, and infrastructure maintenance domains. Topics include classification: linear regression, logistic regression, K-NN, and other classifiers; dimensionality reduction; clustering: K-means, hierarchical clustering, Gaussian mixture models, density-based clustering; model validation; and text mining. Demonstrates the applicability and underlying principles of the various methods through case studies with extensive data sets. Applications include classification of pavement distress images; mobility patterns; real-time transportation demand prediction; and text mining from reports. Background in probability and statistics and familiarity with Python/R recommended.

**CIVE 7151. Urban Informatics and Processing. (4 Hours)**

Offers a comprehensive review of urban informatics in civil and infrastructure engineering research. Discusses the usage of these data and offers students hands-on opportunities to extensively analyze, comprehend, and visualize five types of data sets: construction and infrastructure development; urban mobility and traffic; sensors in built environments; geosocial networks; and social media. Provides extensive data sets for practices. Python is the main platform for analysis and visualization.

**CIVE 7155. Dynamics and Control of Infrastructure Systems. (4 Hours)**

Introduces the fundamentals of modeling, optimization, and control of dynamic and automated infrastructure systems. The future of infrastructure engineering will be increasingly automated: building automation systems, autonomous vehicles, smart-grids, and responsive pollution controls. Emphasizes linear systems, including continuous and discrete-time systems, but also presents elementary concepts in nonlinear systems. Additional topics include stability, observers, optimal control, system identification, and cyber-physical system architectures. Offers students an opportunity to acquire practical and theoretical knowledge of control technologies and to apply these modern tools to a semester-long project in their area of interest and to develop the analytical, numerical, and conceptual methods necessary for careers in the emerging field of automated infrastructure systems.

**Prerequisite(s):** MATH 2341 with a minimum grade of D- or graduate program admission

**CIVE 7220. Construction Management. (4 Hours)**

Presents all aspects of construction management, with emphasis on cost and schedule. Provides conceptual and detailed cost estimates and network-based scheduling techniques (CPM and PERT). Covers project cash flow and finances. Requires one semester of undergraduate probability and statistics.

**CIVE 7230. Legal Aspects of Civil Engineering. (4 Hours)**

Overviews the U.S. legal system and the theories necessary for the comprehension of business and contractual liabilities. Discusses various types of contracts, forms of business ownership, claims and disputes, and environmental law.

**CIVE 7240. Construction Equipment and Modeling. (4 Hours)**

Focuses on the selection and application of earthmoving equipment. Topics include equipment production systems and cost analysis, simulation modeling of equipment operations, statistical aspects of computer simulation, and risk analysis fundamentals. Requires one semester of construction management or one semester of undergraduate soil mechanics.

**CIVE 7250. Environmental Chemistry. (4 Hours)**

Examines applications of chemistry to environmental engineering. Covers properties of water and pollutants, acid-base reactions, pH, alkalinity, equilibrium chemistry, chemical kinetics, chemical thermodynamics, coordination chemistry, precipitation-dissolution reactions, surface chemistry, adsorption-desorption, redox reactions, and organic chemistry as it relates to the environment. Includes relevant laboratory exercises such as colorimetry, gravimetric, and electrochemical methods; atomic absorption spectrophotometry; and ion and gas chromatography. Requires one semester of undergraduate chemistry.

**CIVE 7251. Environmental Biological Processes. (4 Hours)**

Examines microbiology with emphasis on biological processes in environmental engineering applications. Topics include cell structure, morphology, cell nutrition and growth, energy transfer and utilization, aerobic and anaerobic microbial metabolism, biological wastewater process theory and modeling, biological nutrients removal, and disinfection of relevant microorganisms. Includes relevant laboratory exercises of treatment parameters used to monitor the biological processes, such as BOD, TOC, COD, gravimetric methods, and dissolved oxygen. Also covers enzyme kinetics and evaluation of kinetic coefficients for biotreatment. Requires one semester of undergraduate chemistry or one semester of undergraduate biology.

**CIVE 7255. Environmental Physical/Chemical Processes. (4 Hours)**

Examines the processes of physical and chemical phenomena related to water quality and water treatment within environmental engineering. Presents the use of fundamental theory, mathematical description, and applied knowledge of these processes and how they are used to characterize water quality in natural systems (lakes, rivers) and to predict performance in engineered systems (water treatment systems). Uses a mass balance and reaction kinetics approach to derive analysis and design equations for water treatment unit operations. Covers physical and chemical processes, including reaction kinetics, flow regimes, dissolved solute removal, particulate removal, phase transfer processes, and redox processes. Includes laboratory demonstrations. Basic knowledge of water quality, environmental chemistry, and differential equations preferred.

**CIVE 7260. Hydrologic Modeling. (4 Hours)**

Covers the vertical and lateral fluxes and stores of water within the terrestrial hydrologic cycle such as precipitation (rain and snow); infiltration; runoff; snowmelt; evapotranspiration; streamflow; groundwater recharge/discharge; and surface (snowpack, lakes, rivers) and subsurface (soil moisture and groundwater) storages. Individual simulation models are developed to represent key processes within the hydrologic cycle. Process models are then integrated to approximate the hydrologic cycle of a watershed. Covers model parameterization, calibration, validation, and uncertainty (model parameters and forcings). Knowledge of geographic information systems and programming is recommended.

**CIVE 7278. Air Quality Modeling and Forecasting. (4 Hours)**

Provides the fundamentals of numerical modeling of urban, regional, and global air quality. Covers the chemistry, physics, and transport required for the understanding, development, application, and evaluation of air quality models. Reviews the history and current status of air quality modeling and forecasting and provides students with hands-on computer practice. Discusses different computer modeling techniques for solving major atmospheric processes used in current air quality models.

**Prerequisite(s):** CIVE 5366 with a minimum grade of C- ; CIVE 5368 with a minimum grade of C-

**CIVE 7279. Advanced Air Quality. (4 Hours)**

Describes in detail the sources, formation, distribution, dynamics, transport, and removal of air pollutants, the interaction of atmospheric chemistry and climate, the radiative and climatic effects of gases and particles, and the formulation of chemical transport models for the atmosphere. Reviews important publications in leading journals.

**Prerequisite(s):** CIVE 5366 with a minimum grade of C- ; CIVE 7278 with a minimum grade of C-

**CIVE 7281. Coastal and Nearshore Hydrodynamics. (4 Hours)**

Presents the basic principles and theories of coastal and nearshore hydrodynamics as well as related engineering applications, including water waves, wave transformation and breaking, wave-induced nearshore circulation, wave setup, wave run-up, fluid vegetation interaction, wave-current interaction, storm surges, tide and wind-driven circulation, and tidal inlet hydraulics. Previous study of graduate-level mathematics is strongly recommended.

**Prerequisite(s):** (CIVE 5281 with a minimum grade of C- or CIVE 5281 with a minimum grade of C- ) or (EEMB 5516 with a minimum grade of C- or EEMB 5516 with a minimum grade of C- )

**CIVE 7282. Coastal and Hydraulic Modeling. (4 Hours)**

Introduces the numerical methods for solving the partial differential equations that govern coastal and riverine processes relevant to coastal and hydraulic engineering, including both energy- and momentum-based models for wave generation and propagation, nearshore non-linear wave transformation, coastal and estuarine circulation, storm surges, riverine flows, fluid-structure interaction, and sediment transport. Emphasizes the finite-difference method, while other commonly-used numerical methods for coastal and hydraulic engineering applications are discussed and compared. Uses examples and case studies of open-source models to illustrate applications of numerical modeling to solve real-world problems.

**Prerequisite(s):** CIVE 5281 with a minimum grade of C- or CIVE 5281 with a minimum grade of C- or CHME 7350 with a minimum grade of C-

**CIVE 7301. Advanced Soil Mechanics. (4 Hours)**

Studies characterization of soils, soil mineralogy and chemistry, stresses within a soil mass, basic porous media flow principles, effective stress principle, compaction, drained and undrained stress-strain-strength concepts, and consolidation theory and its application. Requires one semester of undergraduate soil mechanics.

**CIVE 7302. Advanced Foundation Engineering. (4 Hours)**

Focuses on bearing-capacity and settlement analysis of conventional shallow foundations and combined footings; mat design; lateral earth pressure theory and application to retaining wall design, braced excavations, sheet pile wall design, and slurry trench walls; bearing-capacity design and analysis for deep foundations; and laterally loaded piles, friction piles, and pile-driven analysis. Requires one semester of undergraduate soil mechanics.

**CIVE 7311. Soil and Foundation Dynamics. (4 Hours)**

Considers dynamic loads, blast vibrations and monitoring, dynamic response of single-mass, multi degree-of-freedom systems, design of machine foundations, dynamic soil properties, ground response analysis, liquefaction, and seismic analysis of slopes and dams. Requires one semester of undergraduate statics.

**CIVE 7312. Earthquake Engineering. (4 Hours)**

Studies plate tectonics, seismology, faults and characteristics, ground motions, seismic hazard analysis, dynamic response of single degree-of-freedom system, response spectrum, site effects, and seismic design considerations for buildings, bridges, and earth-retaining structures. Requires one semester of undergraduate statics.

**CIVE 7313. Ground Improvement. (4 Hours)**

Addresses how problematic groundwater conditions, low shear strength, high compressibility, and the need for remediation can be resolved through ground improvement, which is the application of innovative technologies and construction techniques designed to improve the engineering properties of the existing soil and rock at a site. Emphasizes specific, well-established, and emerging ground improvement technologies, including their applications, design, construction/implementation, and quality control.

**CIVE 7330. Advanced Structural Analysis. (4 Hours)**

Explores modern methods of structural analysis, matrix formulation of flexibility and stiffness methods, and analysis of structures with material and geometric nonlinearities. Also introduces energy methods. Requires CIVE 5522 or one semester undergraduate matrix structural analysis.

**CIVE 7331. Structural Dynamics. (4 Hours)**

Examines single and multi degree-of-freedom systems subjected to arbitrary dynamic loads. Topics include convolution and frequency domain solutions, introduction to analytical dynamics, damping models, modal analysis of classically damped systems, and state-space formulation. Requires one semester of undergraduate structural analysis.

**CIVE 7340. Seismic Analysis and Design. (4 Hours)**

Considers the response of linear systems to coherent and incoherent support motion, nonlinear response, the concept of ductility, inelastic response spectra, soil-structure interaction, random vibration theory, development of seismic codes, and characterizations of earthquakes for design.

**Prerequisite(s):** CIVE 7331 with a minimum grade of C-

**CIVE 7341. Structural Reliability. (4 Hours)**

Examines applications of probability theory and random variables for determining the reliability of structures. Includes the following topics: formulation of reliability for structural components and systems; first-order second-moment method, first- and second-order reliability methods, and simulation methods; analysis of model uncertainty and Bayesian parameter estimation technique; load and resistance models and bases for probabilistic structural codes; and time-dependent reliability methods. Assumes no prior knowledge of probability theory.

**CIVE 7342. System Identification. (4 Hours)**

Studies methods for identifying the fundamental characteristics of structures. Includes topics in linear algebra (singular value and QR decomposition, pseudoinversion, and so on); input-output relationships for linear time-invariant systems; frequency response functions; signal processing fundamentals; realization theory; the eigensystem realization algorithm; use of observers in identification; and introduction to out-only system identification.

**CIVE 7350. Behavior of Concrete Structures. (4 Hours)**

Considers flexural mechanics of reinforced concrete cross sections and members; combined bending, axial, and shear loads; advanced topics in shear, torsion, and connection design; and application of plastic analysis to reinforced concrete frames, their behavior under cyclic loading, and response of structures under seismic actions. Requires one semester of undergraduate concrete design.

**CIVE 7351. Behavior of Steel Structures. (4 Hours)**

Studies the behavior and design of steel structural systems, including structural stability; advanced topics in mechanics and design of structural steel members, including combined axial, flexure, and shear loads; composite steel/concrete beam and column behavior and design; plate girders; and advanced topics in connection design. Requires one semester of undergraduate steel design.

**CIVE 7354. Wind Engineering. (4 Hours)**

Covers atmospheric circulation, atmospheric boundary layer winds, bluff-body aerodynamics, introduction to random vibration theory, response of structures to fluctuating wind loads, aeroelastic phenomena, wind-tunnel and full-scale testing, nonsynoptic winds (hurricanes, tornadoes, etc.), wind-load standards, and design applications.

**CIVE 7355. Advanced Bridge Design. (4 Hours)**

Studies the behavior and design of prestressed concrete bridges. Includes conceptual design, flexural design, shear design, and torsional design of prestressed elements. Analyzes indeterminate prestressed structures and design for prestressed concrete bridges, including material properties, loads, reinforcement, structural analysis, temperature effects, and construction methods. Covers solid slab, T-beam, and box girders. Final projects include complete designs for a simple supported girder bridge and a continuous girder bridge using load factor and resistance design (LFRD) specifications.

**Prerequisite(s):** CIVE 5525 with a minimum grade of C-

**CIVE 7357. Advanced Structural Mechanics. (4 Hours)**

Covers stress and strain analysis of structural components, including beams and plates subject to bending, shear, tension, and compression, as well as nonsymmetric geometry and loading cases. Considers the derivation and analysis of elastic instabilities of structural components, including the lateral, torsional, and lateral-torsional buckling of beams and the inelastic yielding and concentrated plasticity of beam components. Includes 3D stress and strain analysis for elastic and inelastic continua as related to advanced structural problems. Introduces variational methods. Requires one semester of graduate structural analysis.

**CIVE 7380. Performance Models and Simulation of Transportation Networks. (4 Hours)**

Reviews concepts and methods for the analysis of the performance of complex transportation systems and approaches for planning, design, monitoring, and management and control of traffic flows over complex transportation networks. Topics include deterministic and probabilistic models, elements of queuing theory, network optimization algorithms, and simulation. Includes applications in traffic flow modeling, capacity analysis of diverse transportation facilities, level of service and estimation of delays, optimal design of transportation network services, and traffic assignment on congested networks.

**CIVE 7381. Transportation Demand Forecasting and Model Estimation. (4 Hours)**

Studies methods used for model estimation, model building, and interpretation of results. Emphasizes travel demand forecasting, including trip generation, distribution, model choice, and route choice. Topics include aggregate and disaggregate models, including discrete choice (binary and multinomial logit and extensions), model building and statistical testing, aggregation, sampling, and sample design. Demonstrates the applicability and underlying principles of the various models through case studies with focus on practical aspects and interpretation. Bases main methodological approaches on econometric methods, mainly on regression modeling and maximum likelihood estimation. Uses general and specialized software tools for data analysis and model estimation. While the focus is on estimating transportation demand models, the methods are applicable to a broad class of applications in engineering, marketing, etc.

**CIVE 7382. Advanced Traffic Control and Simulation. (4 Hours)**

Covers analysis and design of traffic signal control, including actuated control, coordinated control, transit signal priority, and signal control schemes for better accommodating pedestrians and bicycles. Includes the study of traffic microsimulation for urban street networks, including modeling techniques and simulation-based evaluation, and intersection performance models. Offers students an opportunity to practice with standard microsimulation software, including coding traffic signal control logic.

**CIVE 7383. Sediment Transport and Applications. (4 Hours)**

Builds on the fundamentals of fluid mechanics and nearshore hydrodynamics to explore the deceptively simple, yet universally complex, problem of sediment transport: how to describe and predict sand movement under water. Explores this question via simple one-line models and complex 3D models of sediment transport; the lab and field experiments underpinning these models; the particular challenge of mixed media transport, including the issues associated with different sediment grain sizes; the structure and importance of turbulence closure models; and coastal resilience and coastal community issues reliant on sediment transport physics.

**Prerequisite(s):** CIVE 7281 with a minimum grade of C-

**CIVE 7385. Public Transportation. (4 Hours)**

Studies the analysis, planning, and operational design of urban public transportation systems. Topics include service planning and scheduling; service reliability and operational control; automated systems for location, fare collection, and passenger counting; service performance measurement; rail system operations and design; data collection; ridership estimation; demand forecasting; pricing; and coordinated transit and land-use planning. Introduces supporting mathematical methods in optimization, random processes, and statistical sampling. Requires knowledge of probability theory.

**CIVE 7387. Design Aspects of Roadway Safety. (4 Hours)**

Concentrates on roadway design features that affect safety, including system users and design elements. Topics include crash causation and countermeasures, statistical procedures for crash analysis, and geometric design improvements for roads and intersections. Analyzes crash data, including both intersecting and nonintersecting locations. Presents concepts, including design, to create a safer transportation system while addressing specific high-crash locations.

**CIVE 7388. Special Topics in Civil Engineering. (4 Hours)**

Offered when the need for a special topic is evident to faculty and students. The course is initiated by the appropriate faculty members and discipline committee and approved by the department. May be repeated twice.

**CIVE 7392. Special Topics in Environmental Engineering. (4 Hours)**

Offered when the need for a special topic is evident to faculty and students. The course is initiated by the appropriate faculty members and discipline committee and approved by the department. May be repeated without limit.

**CIVE 7400. Seminar. (0 Hours)**

Presents topics of an advanced nature by staff, outside speakers, and students in the graduate program. This course must be attended every semester by all full-time graduate students in the Department of Civil and Environmental Engineering. Environmental engineering students permitted. May be repeated without limit.

**CIVE 7945. Master's Project. (4 Hours)**

Offers students an opportunity for individual effort consisting of laboratory, literature and/or computational investigation, analysis of results, and preparation of a definitive report as part of an advanced research project in an area of civil engineering determined by the student and their advisor.

**CIVE 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CIVE 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**CIVE 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**CIVE 7990. Thesis. (4 Hours)**

Offers analytical and/or experimental research conducted by arrangement with and under the supervision of the department.

**Prerequisite(s):** CIVE 7945 with a minimum grade of C-

**CIVE 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers continued thesis work conducted under the supervision of a departmental faculty.

**CIVE 8960. Exam Preparation—Doctoral. (0 Hours)**

Offers students an opportunity to prepare for the PhD qualifying exam under faculty supervision. Intended for students who have completed all required PhD course work and have not yet achieved PhD candidacy; students who have not completed all required PhD course work are not allowed to register for this course. May be repeated once.

**CIVE 8984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**CIVE 8986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**CIVE 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of program requirements for PhD candidacy.

**CIVE 9984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**CIVE 9986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**CIVE 9990. Dissertation Term 1. (0 Hours)**

Offers analytical and/or experimental research conducted by arrangement with and under the supervision of the department. Open to full-time students only. Requires PhD candidacy in civil engineering or in interdisciplinary engineering.

**Prerequisite(s):** CIVE 9000 with a minimum grade of S

**CIVE 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** CIVE 9990 with a minimum grade of S

**CIVE 9996. Dissertation Continuation. (0 Hours)**

Offers continued thesis work conducted under the supervision of a departmental faculty.

**Prerequisite(s):** CIVE 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Commerce and Economic Development - CPS (CED)

**CED 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CED 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CED 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CED 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CED 5020. Applied Macroeconomic Theory 1. (2.25 Hours)**

Surveys the policy and practice of macroeconomics, exploring the link between economic theory and current economic policy. Introduces students to the variables used for macroeconomic analysis, such as national output, unemployment, interest rates, government debt, and inflation. Emphasizes the tools used for analyzing current macroeconomic policies, such as fiscal policy and monetary policy.

**CED 5030. Mathematical Methods for Economics 1. (2.25 Hours)**

Covers applications of mathematics to economics: functions, simultaneous equations; linear models and matrix algebra; determinants, inverse matrix, Cramer's rule; differentiation and optimization of functions of one or more variables; quadratic forms, characteristic roots and vectors, constrained optimization; and interpretation of the Lagrange multiplier. Applies techniques to examples from the theory of the firm and consumer behavior.

**CED 5050. Commerce and Economic Development. (2.25 Hours)**

Explores introductory material in economics, finance, and mathematics relevant for graduate studies. Covers basic concepts of micro- and macroeconomics, statistics, optimization, and market basics.

**CED 6010. Applied Microeconomic Theory 1. (3 Hours)**

Covers decision theory, theory of the firm, and consumer behavior; introduction to general equilibrium theory and welfare economics; game theory, including extensive form solution concepts, bargaining, and repeated games; and information economics, contract theory, and mechanism design.

**Prerequisite(s):** CED 6050 with a minimum grade of C-

**CED 6011. Applied Microeconomic Theory 2. (3 Hours)**

Offers a deep exploration into game theory, including extensive form solution concepts, bargaining, repeated games, information economics, contract theory, and mechanism design.

**Prerequisite(s):** CED 6010 with a minimum grade of C-

**CED 6020. Applied Macroeconomic Theory 1. (3 Hours)**

Develops a coherent framework for analyzing the determination of macroeconomic variables such as national output, unemployment, interest rates, government debt, and inflation. Explores the link between economic theory and current economic policy. Offers students an opportunity to learn the tools to analyze current macroeconomic policies.

**Prerequisite(s):** CED 6050 with a minimum grade of C-

**CED 6021. Applied Macroeconomic Theory 2. (3 Hours)**

Exposes students to the skills needed for interpreting macroeconomic data and macroeconomic policy. The course is designed to provide a link between economic theory and current economic policy and to provide students with the tools to analyze current macroeconomic policies.

**Prerequisite(s):** CED 6020 with a minimum grade of C-

**CED 6030. Mathematical Methods for Economics 1. (3 Hours)**

Covers applications of mathematics to economics: functions, simultaneous equations; linear models and matrix algebra; determinants, inverse matrix, Cramer's rule; differentiation and optimization of functions of one or more variables; quadratic forms, characteristic roots and vectors, constrained optimization; and interpretation of the Lagrange multiplier. Applies techniques to examples from the theory of the firm and consumer behavior.

**CED 6031. Mathematical Methods for Economics 2. (3 Hours)**

Explores applications of mathematics to economics: differentiation and optimization of functions of one or more variables; quadratic forms, characteristic roots and vectors, constrained optimization; interpretation of the Lagrange multiplier. Applies techniques to examples from the theory of the firm and consumer behavior.

**Prerequisite(s):** CED 6030 with a minimum grade of C-

**CED 6040. Applied Econometrics 1. (3 Hours)**

Studies statistical tools used to estimate economic relationships. Discusses the linear regression model. Introduces topics relevant to the analysis of economic data, including instrumental variables, discrete choice modeling, panel data analysis, and program evaluation.

**Prerequisite(s):** CED 6030 with a minimum grade of C-

**CED 6041. Applied Econometrics II. (3 Hours)**

Focuses on specific topics in instrumental variables, discrete choice modeling, panel data analysis, program evaluation, and empirical strategies for applied micro research. The purpose of this course is to provide students with a solid foundation in econometric techniques with a focus on techniques that are commonly used in applied economics. Seeks to help students understand issues in connecting data, statistics, and economic theory and to read and precisely understand the econometrics typically used in empirical research for practical and academic purposes. These tools are of practical use to any student who plans on confronting data in their academic and professional work.

**Prerequisite(s):** CED 6030 with a minimum grade of C- ; CED 6040 with a minimum grade of C-

**CED 6050. Commerce and Economic Development. (3 Hours)**

Explores introductory material in economics, finance, and mathematics relevant for graduate studies. Covers basic concepts of micro- and macroeconomics, statistics, optimization, and market basics.

**CED 6051. Open Economy Macroeconomic Analysis. (3 Hours)**

Examines key issues in open economy macroeconomics, including the foreign exchange market, international monetary arrangements, the balance of payments and current account imbalances, national income accounting, the effectiveness of monetary and fiscal policies in open economies, the determinants of exchange rate changes, and the economics of monetary integration.

**Prerequisite(s):** CED 6050 with a minimum grade of C-

**CED 6070. Economics of Human Capital. (3 Hours)**

Focuses on an economic analysis of the labor market, the labor force, and workers' wages and earnings. Includes other topics such as the demand for labor by businesses and industries; wage inequality and its determinants; the changing occupational and industrial structure; the economic impact of unions; and the influence of related labor market institutions and relevant public policies, including minimum wages, wage subsidies, and earned income tax credits. Aims to help early stage entrepreneurs to understand issues of human labor.

**CED 6090. Cultural Economic Development. (3 Hours)**

Examines the role of markets in art, culture, and entertainment in economic development. Includes topics such as the role of the creative economy in attracting tourists and industry and in driving economic growth and the strategic impact of a creative export sector. Explores additional topics such as an analysis of the economics of historic preservation and tourism—for example, rehabilitating historical buildings, funding museums and symphony orchestras, and encouraging traditional arts and tourist activities—to lead job growth and spur economic vitality.

**CED 6110. Law and Economics. (3 Hours)**

Addresses topics such as property rights, regulation, income distribution applied to health and safety, the environment, the legal services and insurance industries, and zoning and land use. Includes additional topics such as new digital information products, international piracy, and intellectual property protections and related issues.

**CED 6120. Environmental Economics. (3 Hours)**

Analyzes efficient allocation of environmental resources and the impact on commerce and economic development. Includes additional topics such as the negative impact of economic activities on air and water with consideration of effective public policy. Explores current issues—such as global warming, habitat and species protection, etc.—and requires consideration of worldwide approaches and solutions to international problems.

**CED 6130. Sustainable Economic Development. (3 Hours)**

Addresses the economics of balancing development and environmental impacts in the context of meeting current and future human needs while protecting the environment. Considers challenges and strategies in both developed and developing economies. Beginning with the market failure resulting from not including environmental impacts in cost calculations, this course explores the competing models of economic development, the environment, and population growth.

**CED 6140. Economics of E-Commerce. (3 Hours)**

Uses theory and analysis of traditional industries to help understand the growth and future of electronic commerce. Includes relevant topics from industrial organization, including monopoly pricing, price discrimination, product differentiation, barriers to entry, network externalities, and search and first-mover advantages. Discusses a number of e-industries, including extensions and applications of the underlying economics, drawing analogies to previous technological revolutions, bubbles in asset markets, and the macroeconomic effects of the Internet.

**CED 6210. Managerial Finance. (3 Hours)**

Offers knowledge and tools to make informed investment and financing decisions. Topics include capital markets, advanced capital budgeting, decision making under uncertainty, asset pricing models, contingent claims models, capital structure, dividend policy, mergers, restructuring and corporate control, and exchange rate systems and international finance.

**CED 6220. International Finance. (3 Hours)**

Studies the international financial and monetary system, emphasizing currency markets. Examines market instruments and techniques, including synthetic and derivative securities and their application to management of currency risk in international trade and finance.

**CED 6230. Quantitative Methods. (3 Hours)**

Explores the development, testing, and application of multiple regression models in financial, economic, and business analysis and forecasting. Course material includes statistical concepts, probability concepts, probability distributions, sampling, hypothesis testing, time series analysis, and multifactor models. Topics are organized around the requirements of the "quantitative methods" portion of the CFA Level I exam.

**CED 6240. Financial Ethics. (3 Hours)**

Studies ethical problems in business and finance and lays the foundations for decisions involving ethical issues. Topics include ethical concepts, including personal integrity, financial industry ethical norms, and company loyalty and responsibility conflicts as they impact decision processes in the functional areas of finance. Organizes topics around the requirements of the ethics portion of the CFA Level I exam.

**CED 6250. Derivatives and Alternative Investments. (3 Hours)**

Introduces the mechanics of derivatives markets and types of available derivatives investments. Examines the fundamentals of the future markets, hedging strategies using futures, the market of SWAPS, and the mechanics of the options markets. Topics are organized around the requirements of the "derivatives" portion of the CFA Level I exam.

**CED 6910. Capstone: Master's Project. (4 Hours)**

Offers students, working in individuals and groups, an opportunity to design and carry out an interdisciplinary economic policy analysis comparable to those performed for a government or nonprofit agency. Projects can be done with real-world clients and utilize experience learned from co-op or experiential learning projects.

**Prerequisite(s):** CED 6010 with a minimum grade of C- ; CED 6020 with a minimum grade of C- ; CED 6030 with a minimum grade of C- ; CED 6040 with a minimum grade of C- ; CED 6050 with a minimum grade of C-

**CED 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CED 6983. Special Topics. (1-4 Hours)**

Covers special topics within the realm of Commerce and Economic Development.

**CED 6995. Project. (1-4 Hours)**

Focuses on an in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Communication Studies (COMM)****COMM 1000. Communication Studies at Northeastern. (1 Hour)**

Designed to provide a unique opportunity to engage faculty, professional staff, and peer mentors in small group discussions. Introduces students to the College of Arts, Media and Design. Offers students an opportunity to learn about the communication studies major and to explore the different areas of emphasis offered by the department. As part of the course, students are expected to prepare a detailed plan of study and are introduced to the co-op program and meet their academic co-op advisor.

**COMM 1101. Introduction to Communication Studies. (4 Hours)**

Surveys the field of communication studies. Covers major theories and methodological approaches in communication studies and situates communication within larger social, political, and economic institutions. Exposes students to ways of ethical reasoning across communication contexts, including organizational communication, social media, intercultural communication, mass media, and interpersonal communication.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**COMM 1112. Public Speaking. (4 Hours)**

Develops skills in public communication. Topics include choosing and researching a topic, organizing and delivering a speech, handling speech anxiety, listening critically, and adapting language to an audience. Offers the opportunity for students to present a series of speeches and receive advice and criticism from an audience.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 1113. Business and Professional Speaking. (4 Hours)**

Designed to assist students in developing advanced public speaking and presentational skills for professional and leadership positions. Covers fundamentals such as audience, speech objectives and structure, and effective delivery. Emphasizes the production and successful interaction with electronic and traditional supportive media. Offers students an opportunity to develop their presentational skills in a variety of settings and realistic business tasks.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 1120. Principles of Argumentation. (4 Hours)**

Considers how the theories and techniques of argumentation can be used to understand and promote differing points of view, explore ideas and alternatives, and convince others of the need to change or act. Starts with the principles of formal logic and introduces students to truth tables and diagramming techniques. Continues to discuss informal logic and modern argumentation theory, including argumentative reconstruction, argument structures, argument schemes and critical questions, as well as informal fallacies. Concludes with a discussion of the effective use of reasoning in society from a logical, dialectical, and rhetorical point of view.

**Attribute(s):** NUpath Formal/Quant Reasoning

**COMM 1122. Storytelling Across Media. (4 Hours)**

Storytelling Across Media introduces students to the field of digital storytelling. Students are introduced to the fundamentals of audio, video, and web necessary to communicate and enhance all forms of storytelling in today's world. Students will build an online portfolio of original stories, developing professional production values and your creative voice. The course focuses on place-based storytelling: stories where the setting matters, and place becomes a key subject or character. Students will develop a cohesive portfolio of works and assignments that demonstrate awareness of the role of storytelling in communication.

**COMM 1125. Science, Communication, and Society. (4 Hours)**

Introduces the major areas of research analyzing the role of communication and the media in shaping debates over science, technology, and the environment. Focuses on what U.S. National Academies calls the "science of science communication" to offer students an opportunity to acquire the knowledge necessary to assess the interplay between science, engineering, and society, including the implications for strategic communication, public engagement, personal decisions, and career choices. Examines the scientific, social, and communication dimensions of debates over climate change, evolution, human genetic engineering, childhood vaccination, food biotechnology, and other case studies. Covers how to find, discuss, evaluate, and use expert sources of information; to formulate research questions and expectations; to think effectively about professional situations and choices; and to write evidence-based, persuasive papers and essays.

**Attribute(s):** NUpath Societies/Institutions

**COMM 1131. Sex, Relationships, and Communication. (4 Hours)**

Focuses on communication within the context of close relationships. Topics covered include the role of communication in interpersonal attraction, relationship development, relationship maintenance, and relationship dissolution. Examines how communication impacts relationship quality and commitment. Offers students an opportunity to apply what they learn in the course to their personal and professional lives.

**Attribute(s):** NUpath Societies/Institutions

**COMM 1210. Persuasion and Rhetoric. (4 Hours)**

Seeks to teach students to be more astute receivers and producers of persuasive messages by learning how to dissect them. Examines both classical and contemporary theories of persuasion, after which students consider “persuasion in action”—how persuasion is used in everyday language, nonverbal communication, sales techniques, politics, and propaganda. Ethical issues in persuasion are addressed throughout the course.

**Attribute(s):** NUpath Interpreting Culture

**COMM 1225. Communication Theory. (4 Hours)**

Explores communicative and cultural practice from a wide variety of theoretical perspectives. Considers a wide range of cultural practices, texts, and artifacts, including popular culture (television shows, movies, and video games); social media and online content; as well as organizational communication (press releases) and interpersonal interactions (conversations between romantic partners). Communication theory is based on two premises: Our cultural assumptions inform and shape our ability to communicate; and communication is the process through which culture is created, modified, and challenged.

**Attribute(s):** NUpath Interpreting Culture

**COMM 1231. Principles of Organizational Communication. (4 Hours)**

Surveys the communication process in complex organizations. Topics include the evolution of organizational communication, communication networks, information management, and communication climate. Analyzes case studies and teaches how to improve the quality of communication in an organization.

**Attribute(s):** NUpath Interpreting Culture

**COMM 1255. Communication in a Digital Age. (4 Hours)**

Covers digital communication's history, technical basis ("protocol" and the "Web"), communicative effects, commercial applications, culture, and societal interactions. Digital communication is central to contemporary life and is (consequently) often taken for granted, which this course seeks to remedy. Applies practical skills relative to theories about collaboration and cultural production and engagement with and analyses of online cultures. Offers students an opportunity to become effective online communicators—using practical exercises such as email filtering, online collaboration, and writing in a Web markup format—and to make use of critical thinking to understand and engage with issues such as online privacy, gender and racial bias, and marketplace credibility and fraud.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**COMM 1320. How to Be Reasonably Funny. (4 Hours)**

Introduces the principles and techniques of humor theory and practice. Critically tests humor models in class and applies them to humorous artifacts (critique), as well as uses them as guidance for humor production (creative practice). Contrasts these humor models with theories of ethics, reasonableness, and power to assess limits of reasonable and ethical use of humor, as well as best practices for humor production and evaluation. Brings together theory and practice at the intersection of humor, ethics, and reasonableness as a way to explore the wider field of contrasting communicative norms as a whole. Examines when and why humans feel humor, as well as how humor interacts with ethics and reasonableness.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Ethical Reasoning

**COMM 1331. Legal Argumentation, Advocacy, and Citizenship. (4 Hours)**

Seeks to train students in effective civic engagement by studying legal argumentation, while preparing students for careers in which persuasive skills are critical to success. Offers students an opportunity to study historical documents to understand the processes of argumentation and to develop arguments by performing detailed research about contemporary issues.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Interpreting Culture

**COMM 1412. Social Movement Communication. (4 Hours)**

Examines the communication strategies (including rhetorical messaging, public advocacy, grassroots organizing, fund-raising, and media outreach) of historical and contemporary social movement and activist organizations. Social movements considered may include immigration protests, AIDS activism, environmental advocacy, disability movements, racial justice, and feminism.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**COMM 1450. Sound Production for Digital Media. (4 Hours)**

Designed to prepare students to work with audio in modern media settings. Introduces the process of planning, preparing, producing, and evaluating audio production styles and techniques. Through a series of discussions, screenings, homework, and in-class exercises, offers students an opportunity to gain the skills needed to produce successful audio recordings. Exposes students to the elements and terminology of audio production as they record, mix, and produce their own original projects.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 1511. Communication and Storytelling. (4 Hours)**

Engages students in the discovery of varied and culturally diverse texts in the literary genres of poetry, prose, and drama. Students focus on analyzing an author's meaning and communicating that meaning to an audience through interpretive performance.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 1600. Communication Ethics. (4 Hours)**

Focuses on ethical principles, issues, and dilemmas in communication. Covers professional codes as well as personal, interpersonal, small group, organizational, and societal factors affecting ethical mediated communication. Designed to stimulate the moral imagination, reveal ethical issues inherent in communication, and provide resources for making and defending choices on ethical grounds.

**Attribute(s):** NUpath Ethical Reasoning

**COMM 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**COMM 2100. Elements of Debate. (4 Hours)**

Introduces the principles and skills of effective argument. Topics include the process of advocacy, how to develop an argument through reasoning, the psychology of argument, and motivational techniques of argumentation. Combines theory and practice in argument through individual presentations and team debates.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 2105. Social Networks. (4 Hours)**

Applies network science theories and methods to understand the connectivity and complexity in the world around us on different scales, ranging from small groups to whole societies. Applies network theories, data collection methods, and visual-analytic analyses to map, measure, understand, and influence a wide range of online and offline social phenomena, including friendships and romantic relationships, professional networks, social media, social influence and marketing, diffusion and viral media, recommender systems, and collective action. Offers students an opportunity to learn to use computational tools to gather and analyze network data, derive data-supported insights, and develop effective network interventions.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**COMM 2110. Sports, Media, and Communication. (4 Hours)**

Addresses the interdependent links between sports and communication. Sports communication is an emerging area within communication studies and journalism programs. Examines the symbiotic relationship between sports and media, as well as how communication affects team culture, player-coach dynamics, crises in sport, race and gender issues, international relationships, and fandom. Requires students to analyze cases and address both pragmatic and ethical factors related to these cases.

**Attribute(s):** NUpath Difference/Diversity, NUpath Ethical Reasoning

**COMM 2131. Dark Side of Interpersonal Communication. (4 Hours)**

Offers students an opportunity to learn about some of the communicative challenges people face in starting, maintaining, and terminating close relationships. The "dark side" is a metaphor used to describe areas of interpersonal and relational communication that are underexplored or "lying in the shadows"; destructive or dysfunctional; and/or poorly understood or often misinterpreted. The dark side perspective acknowledges that while relationships are often a source of joy and satisfaction, they can also elicit feelings of uncertainty, frustration, and pain. Studies the ways in which communication can influence (and possibly resolve) turmoil in close relationships.

**Attribute(s):** NUpath Difference/Diversity

**COMM 2135. Sex and Interpersonal Communication. (4 Hours)**

Explores communication theories and concepts as they relate to the interpersonal study of sex, sexuality, and romance. Offers students an opportunity to understand and articulate individual values, assumptions, and paradigms regarding sexuality and how these fit into current research and theory (as demonstrated through in-class discussions, activities, and the opinion paper assignment). Considers how competing communication perspectives can be contrasted, compared, and/or synthesized for a stronger literacy related to sex, sexuality, and sexual identities in an effort to procure an understanding of how communication research and theory can be utilized in academic, personal, and professional settings. Also focuses on sexual health.

**Attribute(s):** NUpath Difference/Diversity

**COMM 2200. Visual Communication. (4 Hours)**

Analyzes the ways that visual materials impact our daily lives using readings, examples, and discussion. Visual material floods our daily lives, whether we are actively consuming it or it is thrust upon us. As consumers of these images, and especially as communication scholars, we need to think critically about these visual materials and how they shape our perceptions of ourselves and the world around us. Focuses on several methods for critically researching visuals and applies these methods to examine and discuss several kinds of visuals, including photography, film/television, advertisements, arts, and urban spaces. Designed to improve students' critical understanding of the visual, in its various forms, for communication.

**Attribute(s):** NUpath Interpreting Culture

**COMM 2300. Risk Communication. (4 Hours)**

Offers a broad overview of the psychological, social, and communication processes involved in risk perception to better understand how communication influences the way we think about and respond to risk. Cigarette pack warnings, weather advisories, nutrition labels, and town hall meetings are among the many examples of risk communication in daily life. We live in a modern "risk society"—preoccupied with assessing, debating, preventing, and managing potential hazards to our health and safety. Offers students an opportunity to learn how these processes inform the development of effective risk-communication strategies, including institutional risk assessment, stakeholder participation, and formal messaging. Designed to help students both construct and critique risk-communication techniques in the context of contemporary social issues (e.g., texting and driving, pollution, terrorism).

**Attribute(s):** NUpath Societies/Institutions

**COMM 2301. Communication Research Methods. (4 Hours)**

Offers an overview of the concepts, methods, tools, and ethics of communication research. Introduces students to the basic statistical concepts used by communication researchers. Designed to help students become knowledgeable consumers and limited producers of communication research. Offers students an opportunity to learn to read, interpret, and critically evaluate research reports. Exposes students to basic social science concepts and research designs and the fundamentals of conducting and analyzing research using surveys, experiments, and content analyses. Students conduct their own empirical research study as a final project, which entails research design, data collection, data analysis, and a written presentation.

**Attribute(s):** NUpath Analyzing/Using Data

**COMM 2303. Global and Intercultural Communication. (4 Hours)**

Focuses on theories of and approaches to the study of intercultural communication. Emphasizes the importance of being able to negotiate cultural differences and of understanding intercultural contact in societies and institutions. Stresses the benefits and complexities of cultural diversity in global, local, and organizational contexts.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**COMM 2304. Communication and Gender. (4 Hours)**

Presents a theoretical and practical examination of the ways in which communication is gendered in a variety of contexts. Integrates into this analysis how different institutions and interpersonal situations affect our understanding of gender roles. COMM 2304 and WMNS 2304 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**COMM 2350. Producing for the Entertainment Industry. (4 Hours)**

Investigates the role of the producer in the production of content for traditional and new media venues. Explores a variety of distribution systems, including online channels, mobile video, terrestrial/satellite radio, documentary film, and independent films, among other platforms. Examines the producer's role in story conceptualization, budget planning, preproduction, and marketing. Through a series of discussions, screenings, homework writing assignments, and in-class writing workshops, offers students an opportunity to gain the skills to produce commercially viable content.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 2500. Analyzing Conversations in Everyday Life. (4 Hours)**

Considers aspects of talk, such as turn taking, sequence organization, and repair for handling breakdowns, in speaking or understanding. Studies the full range of things people do, such as making requests, blaming others, apologizing, complaining, etc. Having conversations with others is among the things that humans do most. Since talk is a locus of sociality and a site for examining language in use, offers students an opportunity to learn how to make discoveries about the orderliness of social life. By the end of the course, successful students recognize what people are doing with their talk, how to identify communication breakdowns, and learn methods for increasing communication efficiency in everyday and organizational encounters.

**COMM 2501. Communication Law. (4 Hours)**

Introduces the fundamental principles of communication law and ethics. Explores the complex interplay between law (the First Amendment) and ethics (personal and professional responsibilities). Topics covered include blasphemy, commercial speech, copyright, defamation, fighting words, free press/fair trial, hate speech, heresy, incitement, obscenity, political speech, pornography, prior restraint, public forums, special settings (such as schools, prisons, and the military), symbolic speech, threats, and time-place-manner restrictions. Emphasizes ethical issues involving privacy, accuracy, property, and accessibility. The transcendent question in communication law and ethics is whether it is right to exercise the rights granted communication professionals under the First Amendment.

**Attribute(s):** NUpath Ethical Reasoning

**COMM 2510. Social Media Analytics. (4 Hours)**

Introduces concepts and professional best practices in social media analytics. Offers hands-on instruction in analytic techniques for Facebook, Twitter, and other social media platforms, including experiments and observational analyses.

**Attribute(s):** NUpath Analyzing/Using Data

**COMM 2525. Communication and Privacy. (4 Hours)**

Explores the ongoing evolution of legal protections for personal data; maps how new digital technologies offer both the prospect of enhanced privacy protections and radical new forms of surveillance that infringe on privacy; traces how much of our contemporary economy thrives on the witting and unwitting exchange of personal data; and sketches changing popular attitudes toward privacy. Privacy has never been a given: It is constantly remade by a shifting legal, technical, socioeconomic, and cultural landscape. Uses pressing contemporary controversies, rich historical examples, and broader theoretical texts to examine the collision of privacy and other important values, including free speech, transparency and accountability, efficiency, and security. Challenges students to consider privacy as a legal, technical, socioeconomic, and cultural artifact.

**Attribute(s):** NUpath Ethical Reasoning

**COMM 2534. Group Communication. (4 Hours)**

Covers small group decision-making processes, problem solving, and the interpersonal dynamics of groups. Offers students an opportunity to study and increase their level of proficiency in group interaction and to develop skills in working with and in a variety of small groups. Topics include communication dynamics, systems thinking, dialogue, conflict management, leadership, power, and teams within different institutions, including government, higher education, and corporate America.

**Attribute(s):** NUpath Societies/Institutions

**COMM 2550. Television Field Production. (4 Hours)**

Offers advanced training in video production techniques, emphasizing remote location shooting. Includes location scouting, production budgets, writing techniques, equipment location, postproduction editing, and content analysis. Covers the fundamentals of single-camera field production and the nonlinear editing process. Offers students an opportunity to work in teams to produce and direct television using remote video equipment.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 2551. Free Speech in Cyberspace. (4 Hours)**

Examines the intersection of law, policy, and new (or relatively new) information and communication technologies. New technologies offer the possibility of new forms of creativity, political engagement, and social life; they also, however, offer very real opportunities to cause serious reputational harm, promote damaging malicious speech, create new controls on creativity, and violate privacy. Uses readings and in-class activities to consider how values and principles that have historically been deemed important apply to the world of new information and communication technologies. Examines how law and policy shape the development and use of new technologies and, at the same time, investigates how new technologies challenge, undermine, and reconfigure existing law and policy.

**Attribute(s):** NUpath Societies/Institutions

**COMM 2555. Games for Change. (4 Hours)**

Offers students sound introduction to the psychological and behavioral theories of entertainment media with the goal of implementing these theories to the future design and evaluation of games for change. Focuses more on the psychological, behavioral, and social aspects of video games than on pure technical aspects. Organized around a collection of selected readings and real-world games and discussions. The final project is based on reflective thinking, critical evaluation, and creative application.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 2625. Communication, Technology, and Society. (4 Hours)**

Surveys core concepts, histories, and controversies in the design, use, and critical study of communication technologies that both shape and are shaped by social relationships and social institutions (such as work, education, religion, and the family). Offers students an opportunity to learn about different definitions of communication, technology, and society; examine the values and assumptions of social actors who build communication technologies across various cultures and countries; and gain insights into how communication technologies are interpreted, resisted, and remade through ever-shifting institutional and interpersonal social dynamics. Through canonical works and contemporary case studies, students examine communication, technology, and society in the context of relationships, design, identity, mobility, value, labor, ethics, community, and belonging.

**Attribute(s):** NUpath Societies/Institutions

**COMM 2650. The Business of Entertainment. (4 Hours)**

Examines business issues associated with the entertainment industry. One dozen award-winning media industry guest speakers deliver lectures on the vital topics reshaping the entertainment landscape. Through lectures and case studies, introduces students to financing contracts, intellectual property issues, licensing, product placement, marketing and publicity, ratings, the impact of piracy, understanding and leveraging new technologies, and distribution. Offers students an opportunity to master these concepts by organizing into teams and developing an original entertainment industry business product or services. Requires each team to develop a formal business plan that includes a market analysis, a budget, and a marketing plan.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 2655. Television Studio Production. (4 Hours)**

Introduces the process of planning, preparing, producing, and evaluating studio productions. Exposes students to the elements and terminology of studio production using multiple cameras, live switching, audio mixing, and studio lighting. Through a series of discussions, screenings, homework, and in-class exercises, offers students an opportunity to obtain skills in the basics of directing creative and technical talent and the skills needed to produce successful television studio productions.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 2700. Sports Promotion in the 21st Century. (4 Hours)**

Develops frameworks and conceptual tools for understanding the world of sports marketing and promotion in an increasingly global and interconnected world. Drawing on examples from domestic and international sports promotional campaigns and academic literature, explores the promotion of sports at the professional, collegiate, and special event level. Focuses on the role marketing plays in attracting fans and sponsors and communicating effectively with the public. Emphasizes quantitative and qualitative approaches to research as part of a comprehensive approach to the development of an on-campus sports promotional campaign. Covers brand marketing and positioning, sports marketing research, event sponsorship and promotion, social media, public relations and community outreach, and controversial issues in sports.

**COMM 2725. Popular Communication. (4 Hours)**

Offers students an opportunity to engage with a specific genre, using historical and critical methods, to better understand this reciprocal relationship between a people and their moment. Successful completion of this course enables one to recall, compare, and give examples of key concepts and theories in popular communication; understand how the popular shapes and is shaped by its people; understand the historical context of a popular genre; critically analyze a genre with respect to social, economic, and political values and events; and demonstrate proficiency in communicating one's analyses. Genres of popular communication—be they self-help books, speculative fiction, or fashion blogs—reflect the aspirations and fears of a people at their moment in history. Simultaneously, popular communication shapes people's sense of identity, purpose, and worth.

**Attribute(s):** NUpath Interpreting Culture

**COMM 2750. Beyond Television. (4 Hours)**

Designed to teach students how to conceive, pitch, write an outline, and complete a script for a cutting-edge half-hour comedy pilot or drama that might appear on Netflix, Hulu, Amazon, and other emerging, nonlinear networks. Emphasizes the differences and similarities between writing content for streaming vs. broadcasting. Culminates in a final project, in which small groups of students complete an episodic show that will be judged by a panel of professional television writers. Course objectives are achieved through reading professional scripts, critically viewing television content, and participating in group writing assignments and "table reads".

**Attribute(s):** NUpath Creative Express/Innov

**COMM 2800. Sport and Spectacle. (4 Hours)**

Introduces students to the lens of performance studies, the world of sports, and the intersection of the two in the field of communication studies. Addresses performance as a cultural and communicative process that enables us to constitute our identities and our lives. Explores how our lives and identities are performed in space and time, while applying those same concepts to athletes and athletic competition. Offers students an opportunity to understand key concepts in performance studies such as ritual, play, performativity, performing, and performance processes.

**Attribute(s):** NUpath Interpreting Culture

**COMM 2900. Sports, Politics, and Communication. (4 Hours)**

Critiques historical and current examples of the intersection of sport and politics and applies relevant communication theory in written reviews of these events, how those events were covered by the media, and their societal impact domestically and globally. Topics include the influence of sport on political protest; gender, racial, and labor issues; and current marketing practices. Offers students an opportunity to develop frameworks and conceptual tools for understanding the intersection of sport and politics through the lens of communication studies.

**Attribute(s):** NUpath Societies/Institutions

**COMM 2912. Special Topics in Communication Studies. (4 Hours)**

Offers a special topics course in communication studies. Course content may vary from term to term. May be repeated once.

**COMM 2941. Topics in Communication and Technology. (4 Hours)**

Explores a chosen theme pertaining to the critical study of communication technologies that both shape and are shaped by social relationships and institutions. Themes are determined by faculty according to their interests and areas of expertise and engage with a range of canonical and contemporary case studies. May be repeated once.

**COMM 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**COMM 2991. Research in Communication Studies. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision.

**COMM 3200. Mobile Communication. (4 Hours)**

Introduces students to the landscape of mobile communication technologies. Takes a broad view of what "mobile," "communication," and "technology" mean in the past, present, and future, encompassing a range of digital and nondigital objects as well as technological and communicative practices. Covers core concepts and theories in mobile communication, focusing on the impact that mobile hardware and software have on society, culture, and politics.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**COMM 3201. Health Communication. (4 Hours)**

Explores various topics as they relate to health communication including interpersonal aspects, cultural issues, and political complexities of health. Subject matter includes patient-provider communication, organizational systems, advertising in the health industry, and the role of media in the formation of expectations about health and the use of media to promote social change.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**COMM 3230. Interpersonal Communication. (4 Hours)**

Offers an overview of the theory and practice of interpersonal communication with the goal of developing the knowledge and skills to create dialogue in conversation, work through conflict, adapt to change, and establish/maintain relationships. Topics include definitions of the communication process, identity, self-disclosure, verbal and nonverbal language, listening, management of interpersonal conflict, and relational and dialogic communication.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**COMM 3304. Communication and Inclusion. (4 Hours)**

Explores the relationships between communication, social identity, and social inclusion. Focuses on how communication shapes perceptions and positions of social identity categories and how individuals and groups resist and transform identity and promote inclusion through communication. Examines communication and inclusion in the contexts of gender, race, sexual identity, social class, ability, and age. Course topics cover a range of theoretical and practical issues, including diversity in organizational settings and the social construction of identity. COMM 3304 and WMNS 3304 are cross-listed.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Writing Intensive

**COMM 3306. International Communication Abroad. (4 Hours)**

Applies communication theory and practice to a wide range of documents, artifacts, museums, and landmarks. Available to students participating in a Dialogue of Civilizations sponsored by the Department of Communication Studies. Content is adapted by the faculty depending on the location of the class. For example, students may study the classical foundations of communication and contemporary political discourse in Athens or British history and documentary film production in London. Often includes meetings with foreign professors, government officials, community organizers, and local artists that have shaped their own country in unique and innovative ways. May be repeated without limit.

**COMM 3307. Production Practicum Abroad. (4 Hours)**

Combines the process of filmmaking with exploring Britain's multicultural society, offering students an opportunity to obtain firsthand experience to develop a deeper, more complex understanding of the culture, particularly as it is evident in London. Covers all aspects of field production from the preproduction process of intensive research and development of story ideas to the technical aspects of filming, lighting, sound recording, digital editing, and graphics. Students work with remote video equipment that includes HD cameras, audio, and remote editing equipment. Taught in London.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 3320. Political Communication. (4 Hours)**

Reviews the construction and influence of rhetoric in political campaigns, particularly contemporary presidential campaigns. Also studies the impact of mass communication on the outcome of elections. Offers students an opportunity to analyze artifacts from recent political campaigns such as stump speeches, campaign debates, campaign advertising, and formal campaign speeches such as nomination acceptance addresses, concession and victory speeches, and inaugural addresses.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**COMM 3409. Advocacy Writing. (4 Hours)**

Offers an Advanced Writing in the Disciplines (AWD) course. Dedicated to teaching students to write scholarly arguments in the discipline of public advocacy and rhetoric and to translate that work for a general audience. Features both an academic approach to writing in the field of rhetoric and a practical approach to writing persuasively for general audiences.

**Prerequisite(s):** (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C); (COMM 1210 with a minimum grade of D- or COMM 1225 with a minimum grade of D- or COMM 1231 with a minimum grade of D- or COMM 1255 with a minimum grade of D- or COMM 1310 with a minimum grade of D- or COMM 1331 with a minimum grade of D- or COMM 1412 with a minimum grade of D- )

**COMM 3415. Communication Criticism. (4 Hours)**

Offers students an opportunity to deepen their abilities to think critically about texts in a variety of forms such as orations, advertisements, music, and art. Studies methods that may range from close textual analysis to deconstruction to theories of performance. Students are required to write a lengthy research paper that carefully analyzes a rhetorical object.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**COMM 3445. Public Relations Principles. (4 Hours)**

Presents the principles, history, and methods of public relations; processes of influencing public opinion; responsibilities of the public relations practitioner; and analyses of public relations programs. Through case studies and class discussions, offers students an opportunity to confront real-life ethical dilemmas and learn to apply ethical frameworks to evaluate and resolve them. COMM 3445 and JRNL 3425 are cross-listed.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Writing Intensive

**COMM 3450. Voice-Over Artist. (4 Hours)**

Introduces voice-over acting techniques for TV commercials, radio, multimedia, and various styles of presentation for both audio and video projects. Offers students an opportunity to uncover and develop their vocal range as narrator, announcer, character, and spokesperson with effectiveness and emotional authenticity. Covers both the "business" and the technical aspects of being a voice talent. Includes the use of microphones, headphones, and recording equipment while in our audio lab. Studies the essentials of vocal techniques, studio etiquette, and working with direction during a studio session.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 3451. Advertising Practices. (4 Hours)**

Examines the development, procedures, economic functions, and responsibilities of advertising. Explores planning, research, production, and other elements that go into successful advertising. Covers the preparation of advertising for print and broadcast media, including campaign planning, space and time buying, and scheduling.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 3500. Environmental Issues, Communication, and the Media. (4 Hours)**

Analyzes major debates over the environment, climate change, and related technologies such as nuclear energy, wind power, natural gas "fracking," and food biotechnology. Studies the relevant scientific, political, and ethical dimensions of each case; the generalizable theories, frameworks, and methods that scholars use to analyze them; and the implications for effective public communication, policymaker engagement, and personal decision making. Offers students an opportunity to gain an integrated understanding of their different roles as professionals, advocates, and consumers and to improve their ability to find and use expert sources of information; assess competing media claims and narratives; write persuasive essays, analyses, and commentaries; and author evidence-based research papers.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**COMM 3501. Free Speech: Law and Practice. (4 Hours)**

Provides students with an opportunity to better understand freedom and limits to freedom, particularly in the realm of speech and expression. Materials covered range from the philosophy of freedom to historical legal cases about free speech and the press to political correctness and the repression of dissent.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**COMM 3505. Rhetoric of Public Memory. (4 Hours)**

Analyzes the specific ways in which the concepts of power and memory have been deployed and challenged through various rhetorical texts—including museums, memorials, monuments, commemorations, reenactments, film, television, theater, art, photography, music, and internet sites, among others. "Memory" has become a central concept for analyzing problems of historical representation and identities. As representations of the past have been/are used as instruments of power, it is important to study the ways in which various communicative practices and institutions are implicated in the construction, representation, negotiation, and revision of public memory.

**COMM 3530. Communication and Sexualities. (4 Hours)**

Analyzes the ways in which sexualities intersect with issues relating to interpersonal communication, mediated communication, popular culture, identity, and social movements. Discusses outing, media representations, queer identity development, and the HIV/AIDS epidemic. Covers theoretical perspectives from communication and other social science disciplines, gender and sexuality studies, and cultural studies. Students work with a variety of materials, contemporary and historical, theoretical and empirical, fiction and nonfiction. Offers students an opportunity to design, conduct, and write their own original empirical research paper relating to sexualities and communication using class content as a theoretical framework.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Writing Intensive

**COMM 3532. Theories of Conflict and Negotiation. (4 Hours)**

Explores both theories of conflict and potential strategies for more effectively managing conflict in a variety of contexts, that is, interpersonal relationships, organizational settings, and broader societal contexts. Offers students the opportunity to participate in the process of conflict assessment and to explore various negotiation strategies as well as discuss the role of forgiveness in conflict situations.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Ethical Reasoning, NUpath Writing Intensive

**COMM 3560. Inclusive Filmmaking. (4 Hours)**

Focuses on skills for making films accessible and reshaping narratives about disability. Explores methods to analyze and critique ableist representations in media, practical techniques for accessible filmmaking (such as captioning and audio descriptions), and approaches to create documentary films to challenge stereotypes and promote inclusive storytelling. Emphasizes how individuals can contribute to these efforts through the creation of accessible content in film and video industries.

**Attribute(s):** NUpath Difference/Diversity, NUpath Creative Express/Innov

**COMM 3615. #Black Twitter and Black Digital Culture. (4 Hours)**

Uses social and digital media to examine questions about contemporary topics and the histories that contribute to them. Black Twitter stands as a point of entry for this course as we address questions about culture and communication, applying what we learn to better understand the dynamics of race, media, and power in the internet age. Offers students an opportunity to develop their own media products to put their learning into real-world context.

**COMM 3625. Public Relations Practice. (4 Hours)**

Demonstrates practices and techniques employed in the field including organization of events and functions. Studies campaign planning, research, and media relationships.

**Prerequisite(s):** JRNL 3425 with a minimum grade of D-

**COMM 3655. Digital Editing for TV. (4 Hours)**

Addresses the changes in editing practices through digitization and offers students advanced training in nonlinear editing utilizing Avid Media Composer. Introduces the terms and concepts of nonlinear editing as well as the technical/creative aspects of postproduction. Students are expected to have a working knowledge of digital video equipment and Macintosh computer skills.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 3750. Special Effects and Postproduction for Television. (4 Hours)**

Explores a variety of approaches to making special effects for film, video, and the World Wide Web. Offers students an opportunity to utilize cutting-edge technology and to apply state-of-the-art techniques to design and produce innovative special effects. Explores historical, technical, and theoretical aspects of special effects. Topics covered include compositing, matte painting, multiplane animation, explosions, smoke, three-dimensional lighting, particle emitters, chroma keying, motion graphics, video tracking, and more.

**Attribute(s):** NUpath Creative Express/Innov

**COMM 3912. Special Topics in Communication Studies. (4 Hours)**

Offers a special topics course in communication studies. Course content may vary from term to term. May be repeated once.

**COMM 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**COMM 4102. Health Communication Campaigns. (4 Hours)**

Offers an in-depth look at how persuasive health campaigns are designed and executed. Discusses how campaigns are designed to intentionally influence awareness, knowledge gain, and attitude/behavior change. Offers students an opportunity to obtain skills to design and evaluate campaigns through the completion of their own campaign projects and to learn about visual and verbal arguments and the unique ethical and other considerations of health campaigns.

**Prerequisite(s):** COMM 2301 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Capstone Experience

**COMM 4530. Communication and Quality of Life. (4 Hours)**

Seeks to further develop an understanding of the function of communication in life and how that relates to quality of life. Examines the communicative experiences of organizations and relationships using both theoretical approaches and practical experience. Students participate in activities designed to develop knowledge and skills necessary to successfully analyze and address ethical and interpersonal communication issues. Offers students an opportunity to be able to reflect on and assess one's own competence in communication and how one's communication affects one's quality of life and to respectfully consider the ethical complexities of quality-of-life issues in both organizational and interpersonal settings.

**Attribute(s):** NUpath Capstone Experience, NUpath Ethical Reasoning

**COMM 4535. Nonverbal Social Interaction. (4 Hours)**

Offers analytic insight on methods people use to communicate different types of social action through body language. Much of our communication is nonverbal, as it is through our body language that we initiate new relationships (both personal and professional) and communicate anger, frustration, happiness, and grief. Offers students an opportunity to develop an understanding of the tools needed to examine the role nonverbal behaviors (body orientation, gaze direction, gesture, laughter, etc.) have in conveying meaning and constructing and negotiating interpersonal relationships. This course incorporates materials from communication, psychology, anthropology, and sociology.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**COMM 4605. Youth and Communication Technology. (4 Hours)**

Examines how meanings of "youth" and "communication technology" shift in relation to one another and to broader changes in society, culture, politics, and the economy over time. Analyzes how communication technologies (and the content they deliver) positively and negatively affect the social, emotional, and cognitive development of young people and how these changes are influenced by the particular family, school, community, and institutional contexts in which children grow up. Examines how young people differ individually across the life span as well as collectively by class, race, ethnicity, nationality, gender, sexuality, and disability. Requires a final paper at the end of the term in which students articulate and defend positions about youth and communication technology.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions, NUpath Writing Intensive

**COMM 4608. Strategic Communication Capstone. (4 Hours)**

Offers students an opportunity to complete a semester-long, intensive research and writing capstone project related to the field of strategic communication. Research topics can span business, politics, advocacy, entertainment, public health, the environment, and other societal sectors. Building on previous course work, students have an opportunity to gain a deeper scholarly and professional understanding of strategic communication; cultivate professional and academic contacts; and demonstrate mastery of relevant theoretical concepts, professional principles, research methods, and writing approaches. Encourages students to share and translate their findings for relevant academic and professional communities.

**Attribute(s):** NUpath Capstone Experience

**COMM 4625. Online Communities. (4 Hours)**

Considers online community dynamics, including formation, governance, conflict, and exit. Offers students an opportunity to understand and engage with online community and how this relates to topics such as human behavior, identity, and communication online. Reviews contemporary issues and concerns. Engages the question and practice of what it means to develop and maintain a successful online community.

**Attribute(s):** NUpath Capstone Experience, NUpath Integration Experience

**COMM 4631. Crisis Communication and Image Management. (4 Hours)**

Examines theories, models, and strategies related to crisis communication and establishes ethical principles regarding what, how, and when essential elements must be employed for effective and ethical crisis communication. Offers students an opportunity to learn how to distinguish between an incident and crisis; to analyze communication practices and methods applied during a crisis; to apply social scientific theory to explain how and why a crisis occurred; and to draw upon theory to develop effective crisis communication plans. Assesses responses to crises using ethical principles such as transparency, two-way symmetrical communication, and timing. Designed to prepare communication professionals who appreciate the need for responsible advocacy when responding to crises.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**COMM 4755. Production Capstone. (4 Hours)**

Offers advanced training in video production techniques, allowing students an opportunity to develop a deeper theoretical understanding of cohesive marketing strategies. Through case study assessments and hands-on exercises, explores the process of marketing video techniques from designing, building, and executing marketing ideas to evaluating effectiveness and exploring online corporate identities. Offers students an opportunity to hone their skills in all aspects of the production process by incorporating the knowledge they have acquired from previous production courses—from the preproduction process of intensive research and development of story ideas and scriptwriting; producing; to the technical aspects of filming, lighting, green screen, sound recording, digital editing, and graphics.

**Attribute(s):** NUpath Capstone Experience

**COMM 4901. Seminar in Communications. (4 Hours)**

Integrates students' experiences in cooperative education with classroom concepts and theories. Topics include integrative learning, the field of communication, pathways and careers in communication, and the professional communicator. Offers students the opportunity to demonstrate competency in communication skills such as oral reporting, conducting research in communication, and writing.

**Attribute(s):** NUpath Capstone Experience

**COMM 4970. Junior/Senior Honors Project 1. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated without limit.

**COMM 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**COMM 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**Prerequisite(s):** COMM 1101 with a minimum grade of D-

**COMM 4994. Internship in Communication. (4 Hours)**

Offers students the opportunity to gain hands-on experience in the communications industry. Further internship details are available in the department office. May be repeated without limit.

**Prerequisite(s):** COMM 1101 with a minimum grade of D-

**Attribute(s):** NUpath Integration Experience

**COMM 5250. Communication and Technology Research Methods. (4 Hours)**

Presents an in-depth introduction to ethical quantitative, qualitative, and mixed-methods approaches in communication, media, and technology-related research. Offers practice in concept explication and analysis across levels of society—from the individual to the organization. Covers designing and analyzing survey and content data, unstructured and semi-structured interviews, focus groups, ethnography, community-based research, and comparative case studies.

**COMM 5510. Technology and Strategic Communication. (4 Hours)**

Provides a current, integrated, and strategic approach to digital media practice and scholarship applied to strategic communication. Examines research literature on social media, search engine optimization, extended reality, and artificial intelligence and applies concepts studied to a real-world project or campaign. Students critique how digital technologies have been used strategically and develop their own goal-based strategy, content, format, and evaluation plan. Discusses ethical implications and impacts on diverse audiences.

**COMM 6102. Health Communication Campaigns. (4 Hours)**

Offers an in-depth look at how persuasive health campaigns are designed and executed. Discusses how campaigns are intentionally designed to influence awareness, knowledge gain, and attitude/behavior change. Offers students an opportunity to obtain skills to design and evaluate campaigns through the completion of their own campaign projects and to learn about visual and verbal arguments and the unique ethical and other considerations of health campaigns.

**COMM 6304. Communication and Inclusion. (4 Hours)**

Explores the relationships between communication, social identity, and social inclusion. Focuses on how communication shapes perceptions and positions of social identity categories and how individuals and groups resist and transform identity and promote inclusion through communication. Examines communication and inclusion in the contexts of gender, race, sexual identity, social class, ability, and age. Course topics cover a range of theoretical and practical issues, including diversity in organizational settings and the social construction of identity.

**COMM 6320. Political Communication. (4 Hours)**

Covers the major theories about the role of communication in U.S. politics, public opinion, and public policy. Discusses how to formulate and evaluate your own theory-based hypotheses on the influence of media in American democracy. Emphasizes the role and place of the media in a democratic system devoted to the proposition that the government should be responsive to the "will of the people." The course is organized around five subjects that are central to the study of political communication: communication systems and practices; communication effects: media, politics, and society; the politics of entertainment and the changing political information environment; elections, accountability, and the mass media; and media and political institutions.

**COMM 6500. Environmental Issues, Communication, and Media. (4 Hours)**

Analyzes major debates over the environment, climate change, and related technologies such as nuclear energy, wind power, natural gas "fracking," and food biotechnology. Studies the relevant scientific, political, and ethical dimensions of each case; the generalizable theories, frameworks, and methods that scholars use to analyze them; and the implications for effective public communication, policymaker engagement, and personal decision making. Offers students an opportunity to gain an integrated understanding of their different roles as professionals, advocates, and consumers and to improve their ability to find and use expert sources of information; assess competing media claims and narratives; write persuasive essays, analyses, and commentaries; and author evidence-based research papers.

**COMM 6605. Youth and Communication Technology. (4 Hours)**

Examines how meanings of "youth" and "communication technology" shift in relation to one another and to broader changes in society, culture, politics, and the economy over time. Analyzes how communication technologies (and the content they deliver) positively and negatively affect the social, emotional, and cognitive development of young people and how these changes are influenced by the particular family, school, community, and institutional contexts in which children grow up. Examines how young people differ individually across the life span as well as collectively by class, race, ethnicity, nationality, gender, sexuality, and disability. Requires a final paper at the end of the term in which students articulate and defend positions about youth and communication technology.

**COMM 6608. Strategic Communication. (4 Hours)**

Offers students an opportunity to complete a semester-long, intensive research and writing capstone project related to the field of strategic communication. Research topics can span business, politics, advocacy, entertainment, public health, the environment, and other societal sectors. Building on previous course work, students have an opportunity to gain a deeper scholarly and professional understanding of strategic communication; cultivate professional and academic contacts; and demonstrate mastery of relevant theoretical concepts, professional principles, research methods, and writing approaches. Encourages students to share and translate their findings for relevant academic and professional communities.

**COMM 6631. Crisis Communication and Image Management. (4 Hours)**

Examines literature related to crisis communication—including theories, models, and strategies—and establishes ethical principles in terms of what, how, and when essential elements must be employed for effective and ethical crisis communication. Offers students an opportunity to learn how to distinguish between an incident and a crisis; to analyze communication practices and methods applied during a crisis; to apply social scientific theory to explain how and why a crisis occurred; and to draw upon theory to develop effective crisis communication plans. Assesses responses to crises using ethical principles such as transparency (the what element), two-way symmetrical communication (the how element), and timing (the when element). Designed to prepare communication professionals who appreciate the need for responsible advocacy when responding to crises.

**COMM 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**COMM 6995. Research Project. (4 Hours)**

Offers students an opportunity to complete and present a high-level research project. Requires the framing of a significant question or set of questions, the research to find answers, and written communication skills to convey the results to a wide range of audiences. Projects bridge theory and practice and are intended to have an impact on the professional life of students.

**Prerequisite(s):** COMM 5250 with a minimum grade of C-

**COMM 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Communication Studies - CPS (CMN)****CMN 1100. Organizational Communication. (3 Hours)**

Introduces psychological, sociological, and communication theories as they apply to organizational life. Offers students an opportunity to analyze the importance of effective communication for organizations in a rapidly changing environment. Topics include management and leadership, culture and change, diversity, conflict management, and employee engagement. Throughout the course, students are encouraged to examine their communication skills in the context of those competencies necessary in today's complex organizational environments.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**CMN 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CMN 2310. Professional Speaking. (3 Hours)**

Emphasizes the practical skill of public speaking, including methods for overcoming presentation anxiety, and the use of visual aids to enhance speaker presentations. Offers students an opportunity to prepare for a variety of typical public speaking situations and to learn the basic principles of organization and research needed for effective message design and delivery.

**Prerequisite(s):** ENG 1103 with a minimum grade of D- or ENG 1105 with a minimum grade of D-

**CMN 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CMN 3100. Negotiation. (3 Hours)**

Introduces the techniques of dispute resolution. Focuses on the processes of mediation, facilitation, and negotiation. Through readings, lectures, and class activities, offers students an opportunity to explore methods of applying these skills to professional settings.

**Prerequisite(s):** CMN 1100 with a minimum grade of D- or CMN 1103 with a minimum grade of D- or CMN 2210 with a minimum grade of D-

**CMN 3220. Introduction to Public Relations. (3 Hours)**

Offers students an opportunity to gain insight into the role of public relations in assisting organizations to achieve business objectives, ranging from branding and employee recruitment to product launches and stakeholder engagement. In particular, explores the intersection of traditional PR planning methodologies with today's internet, email, and social media communications channels. Flows from the research, strategies, tactics, and evaluation found in effective public relations plans to the major tools that a practitioner can apply to a public relations campaign. These tools include media relations, social media, websites, employee communications, community relations, and events.

**Prerequisite(s):** CMN 1100 with a minimum grade of D-

**CMN 3350. Intercultural Communication. (3 Hours)**

Focuses on gaining an advanced understanding of the concepts associated with culture and communication. Offers students an opportunity to develop intercultural awareness and patterns of perception and thinking to enable effective communication across cultural boundaries. Discusses the effect of cultural differences on communication styles, personal identities, and various organizational contexts.

**Prerequisite(s):** CMN 1100 with a minimum grade of D- or CMN 1103 with a minimum grade of D- or CMN 2210 with a minimum grade of D-

**CMN 3360. Crisis Communication. (3 Hours)**

Introduces important implications of effective internal and external communication during crises. Examines proactive and reactive approaches to crisis communication from an academic and practical perspective. Considers elements of effective crisis communication plans and tactics. Offers students an opportunity to analyze several crisis situations.

**Prerequisite(s):** (CMN 1100 with a minimum grade of D- or CMN 1103 with a minimum grade of D- or CMN 2210 with a minimum grade of D-); CMN 2310 with a minimum grade of D-

**CMN 3410. Digital Communication Strategy. (3 Hours)**

Introduces students to a communication-planning methodology that supports an organization's short- and long-term goals. Defining digital communication objectives, audiences, tactics, channels, and success indicators are all critical components of an effective strategy. Emphasizes content marketing and inbound marketing tactics and how they fit the voice of the customer and the voice of the organization.

**CMN 3800. Designing and Implementing a Promotional Campaign. (3 Hours)**

Offers students an opportunity to design and implement a digitally based promotional campaign for an external sponsoring organization. During the campaign design phase, students become part of a creative team, perform target audience research, analyze the research findings, review key performance indicators, and develop a communication plan. During the campaign implementation phase, students execute the communication plan. Implementation includes creating email marketing and social media marketing messages, calls to action, client presentations, monitoring campaign results, and performing an overall project assessment. Each phase includes project updates to the sponsor and self-reflection on the learning experience. Students develop deliverables and track their work using a leading-edge marketing automation platform.

**Prerequisite(s):** MKT 3010 with a minimum grade of D-

**CMN 3850. Managing Communication Projects. (3 Hours)**

Offers students an opportunity to manage creative teams and develop client relationships during the design and implementation of a promotional campaign for an external sponsoring organization. Topics include project leadership, client management techniques, communication planning methodology, client and team presentations, evaluation of campaign effectiveness, coaching, and supervision.

**Prerequisite(s):** CMN 3800 with a minimum grade of D-

**CMN 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CMN 4850. Capstone in Professional Communication. (3 Hours)**

Seeks to guide students in developing a semester-length service-learning project that integrates theory, practice, creativity, and reflection explored throughout their communication studies. The project helps students deepen knowledge and extend ability within their chosen concentrations by having them analyze and apply what they have learned in pragmatic ways that enhance the learning experience, teach civic responsibility, and strengthen communities. Offers students an opportunity to create a portfolio of meaningful artifacts useful for career entry, development, and advancement in this writing-intensive course.

**Prerequisite(s):** CMN 3800 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Integration Experience, NUpath Writing Intensive

**CMN 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**CMN 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CMN 6000. Introduction to Organizational Communication. (3 Hours)**

Considers writing and other forms of communication as a management tool. Addresses how effective writing—in plain English—can shape project plans, motivate people, solve problems, and enhance one's role as a communicator. Offers students an opportunity to demonstrate their writing and editing skills through research, case study analysis, and composing business-related communications as well as to develop other forms of communication, including oral presentations. As such, the two major goals of this course are to acquaint students with a step-by-step communication methodology and to provide them with an opportunity to develop and polish their writing and communication skills.

**Corequisite(s):** INT 6000

**CMN 6005. Foundations of Professional Communication. (4 Hours)**

Focuses on comprehensive reading and written communication from both academic and professional perspectives and integrates best practices in both. The key to success in any professional field is the ability to communicate effectively. Offers students an opportunity to evaluate personal adaptation to a new cultural and educational setting, including the use of learning resources.

**CMN 6010. Strategic Communication Management. (3 Hours)**

Focuses on the rapidly evolving role of organizational communication in the digital era. Since audience expectations regarding transparency and responsiveness are changing dramatically, the course introduces students to stakeholder analysis and the theory and practice of persuasion. Managing communication strategies requires a strong foundation in communication planning methodology in order to design communication programs and initiatives that support organizational performance. Offers students an opportunity to gain an understanding of the evolving roles and responsibilities of communication functions addressing both internal and external audiences.

**CMN 6020. Ethical Issues in Organizational Communication. (3 Hours)**

Examines ethical questions that directly affect how organizations communicate and what they choose to relay and omit to their various audiences. Organizational women and men are compelled to make ethical decisions when they communicate. Proponents of strategic ambiguity in and for organizations have been confronted and countered by other theorists who reject ambiguity as a euphemism for lying. Analyzes cases and academic studies that reflect how ethical and unethical communication affected the fortunes of organizations. Analyzes and evaluates the practical values of ethical yardsticks.

**CMN 6025. Digital Era Skills: Platforms, Tools, and Techniques. (3 Hours)**

Seeks to help students develop content and community management skills by focusing on specific tools, techniques, and best practices for effective engagement on both public and private platforms (including time and information management skills). Both individual and organizational success in the digital era depends on the development of these skills by professionals in a range of disciplines. Offers students an opportunity to apply concepts by experimenting with various tools and platforms and reflecting on lessons learned from their own active engagement and to learn from the experiences and reflections of their peers.

**CMN 6040. Consumer Behaviors in the Online Environment. (3 Hours)**

Explores important concepts about consumer behaviors in the online environments, including the social media environment and the electronic commerce (e-commerce) environment. Topics include consumer engagement with social media, electronic word of mouth (eWOM), branding and advertising issues in social media, methodological perspectives on social media, consumer expectations and online shopping preferences in the e-commerce environment, and public policy issues in social and digital media.

**CMN 6045. Leveraging Digital Technologies: Strategy, Assessment, and Governance. (3 Hours)**

Focuses on the initial stages of social media initiatives: strategy identification, assessment, and governance considerations. Offers students an opportunity to learn the importance of establishing goals and objectives to guide subsequent development and implementation efforts, how to evaluate the potential for digital technologies to enable the pursuit of those goals and objectives, and how to conduct a comparative assessment of current and potential tools and practices to identify the most efficient and effective approaches. Also offers an opportunity to develop an appreciation for the governance issues that have to be considered once a commitment to leveraging new technologies has been made.

**CMN 6050. Crisis Communication. (3 Hours)**

Examines crisis communication from the perspective of practitioners as well as academics. Both groups have examined accommodation as well as avoidance strategies for crisis communication. Crises are a fact of life in organizations. Natural disasters, sexual harassment charges, psychopathic acts, and product callbacks are a few situations that require intelligent communication to internal and external stakeholders. Includes analysis of several crisis-communication studies, including recommendations for "what I would have done instead." Reviews the elements of an effective crisis communication plan and development of communication tactics for a range of stakeholder audiences.

**CMN 6060. Negotiation, Mediation, and Facilitation. (3 Hours)**

Introduces the techniques of dispute resolution. Emphasizes the processes of mediation, facilitation, and negotiation. Examines techniques suggested by practitioners and researchers regarding best practices for effective negotiation. A central part of the course requires students to participate in and evaluate negotiation simulations.

**CMN 6065. Implementation and Management of Social Media Channels and Online Communities. (3 Hours)**

Focuses on the implementation and management stages of social media initiatives. Offers students an opportunity to learn how to establish/expand an organization's initial presence on multiple platforms, define metrics for measuring success in both the short and longer terms, develop training for community managers and others, evaluate the performance of social media activities and revise strategies/tactics to adapt to feedback, and determine logical approaches for expanding a digital community and developing specific campaigns based on community activity.

**Prerequisite(s):** CMN 6045 with a minimum grade of C-

**CMN 6075. Digital Marketing Analytics. (3 Hours)**

Examines the measurement tools and analytics required to assess the effectiveness of customer acquisition and brand awareness campaigns and tactics. Focuses on the interpretation of marketing data sets and their use in performance dashboards. The ability to assess the impact of marketing communication tactics is a critical skill set. Experience with basic statistical tools is strongly recommended.

**Prerequisite(s):** CMN 6910 with a minimum grade of C-

**CMN 6080. Intercultural Communication. (3 Hours)**

Discusses the impediments to effective intercultural communication and methods for overcoming these impediments. The ease of travel, the pervasiveness of communication technology, and the realities of economic/political interdependence have made it essential for organizational women and men to be capable communicators in intercultural settings.

**CMN 6085. Strategies for Cross-Cultural Facilitation and Negotiation. (3 Hours)**

Examines several cultural theories, such as Hofstede's national cultural dimensions, Hall and Hall's contextual levels, along with Kluckhohn and Strodtbeck's variations in value orientations. Culture is defined as a group of people with shared values and means of being. Offers students an opportunity to acquire skills to move from gut reactions to applying empirically tested methods for cultural interactions and diplomacy. Includes case studies and role-play with a variety of intergenerational, international, racial, and religious groups. Students practice verbal and nonverbal communication to strengthen their diplomacy and public speaking skills. The written signature assignment designs a communication collateral that meets the needs of stakeholders from two different cultures (include different languages/wording). Supports collateral differences based on cultural theories and evidence.

**CMN 6090. Organizational Culture, Climate, and Communication. (3 Hours)**

Examines the relationship between organizational culture and communication and discusses the advantages and elements of a supportive communication climate. Some researchers believe that the culture of the organization drives the communication quality in an organization. Examines both case analysis and academic research to address common problems pertaining to cultivating supportive communication climates and methods for improving these climates.

**CMN 6095. Foundations of Developing Cultural Awareness. (3 Hours)**

Examines culture from three pillars: awareness, language, and history/politics. Offers students an opportunity to investigate their personal identity and barriers by incorporating two assessments to determine personal implicit bias and cultural intelligence. Interpretations are constructed from self-reports employing the cultural intelligence (CQ) assessment and Implicit Bias Project. Focuses on the impact of languages on cultures. By identifying nonstandard language and discussing the meaning of words across different languages, offers students an opportunity to gain understanding and formulate sensitivity when communicating with different audiences, albeit intergenerational and/or international. Examines the impact of history and politics on cultural groups, specifically as related to cross-cultural communication. The written signature assignment is a personal reflection analysis on insights gained throughout the course and career aspirations.

**CMN 6096. Cultural Communications Lab. (1 Hour)**

Introduces cultural communication within an organizational communication context. The lab learning modules and experiential applications support the learner's discovery of cultural resilience and how communication strategies and tools address this emerging global need. Three learning modules introduce students to data literacy, technological literacy, and human literacy. The Cultural Intelligence (CQ), a self-reporting assessment, is the basis of the learner's application to their personal and professional cultural communication development.

**CMN 6100. Communication Networks and Managing Information. (3 Hours)**

Examines new electronic technologies as well as other approaches to disseminating information. Organizations can employ various methods for communicating in organizations. Analyzes what types of information must be communicated in organizations and the impediments to successful transmission of information. Uses case studies to offer students an opportunity to identify problems with information management as well as methods for ameliorating situations caused by poor communication management.

**CMN 6110. Group Dynamics and Interpersonal Conflict: Meeting Management. (3 Hours)**

Examines common problems with organization meetings and intervention techniques that can be employed to reduce the tensions associated with such interaction. Discusses methods used for evaluating individual members in meeting contexts. A central part of the course involves participation in and evaluation of meeting interaction.

**CMN 6150. Communication Research and Strategy. (3 Hours)**

Introduces the first two stages of an organizational communication program—research and strategy. Covers the information gathering a practitioner must perform, from organizational objectives to key stakeholder groups, to develop optimal communications solutions. Includes the three communications elements critical to achieving the desired communications outcomes—audience, message, and channel. Introduces methods for producing communications plans that support organizational performance. Offers students an opportunity to gain an understanding of the evolving roles and responsibilities of different communication functions.

**CMN 6230. Content Creation and Delivery. (3 Hours)**

Considers how internal and external communications networks through digital and nondigital media can be leveraged when designing and executing communication plans. Offers students an opportunity to construct multimedia signature stories to influence target audiences and to support organizational objectives. Explores stakeholder analysis, communication planning methodology, and the principles of persuasion. Students apply concepts by experimenting with various tools and platforms and learning from the experiences and reflections of their peers.

**CMN 6250. Organizational Communication Assessment. (3 Hours)**

Focuses on demonstrating the value of communication activities to the organization. Explores an evaluative framework and measurement tools to make data-driven decisions and recommendations for improvement. Offers students an opportunity to apply the framework to assess a communications channel for real-world organizations.

**CMN 6300. Organizational Culture, Climate, and Communication. (3 Hours)**

Examines the need for communication professionals to understand the environment and context for the communications programs they develop and operate. Explores how ethical issues and intercultural communication both affect and are affected by organizational communication programs. Considers key questions when it comes to topics that can trigger strong stakeholder reactions. Through discussion, real-world scenarios, and case analysis, offers students an opportunity to apply the framework and principles to answer these questions and keep the organization's communications on the right path.

**CMN 6910. Organizational Communication Assessment. (3 Hours)**

Discusses quantitative and qualitative methods for conducting assessments called communication audits. If communication is central to organizational activity, then persons must be able to assess the quality of communication within organizations. Offers students an opportunity to evaluate the advantages and disadvantages of each technique and to participate in conducting a communication audit.

**Prerequisite(s):** CMN 6010 with a minimum grade of C-

**CMN 6940. Projects for Professionals. (4 Hours)**

Offers students an opportunity to apply knowledge and skills gained through their organizational communication master's program to challenging short-term projects under faculty supervision. Students are matched with discipline-specific consulting projects provided by a wide range of sponsoring organizations in the private and nonprofit sectors. They develop a project plan, conduct research, develop and deliver recommendations to the sponsoring organization, and reflect on lessons learned. Mapping organizational communication concepts and skills to the consultative process is a primary learning outcome. Application process is required. This is a capstone course. Students with less than two years of professional communication-related experience must successfully complete a noncredit Experiential Learning project before registering for the capstone course.

**Prerequisite(s):** CMN 6020 with a minimum grade of C ; CMN 6910 with a minimum grade of C

**CMN 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CMN 6980. Capstone. (1-4 Hours)**

Offers students an opportunity to integrate their course work, knowledge, and experiences into a capstone project.

**CMN 6995. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

## Communication Studies - CPS Specialty (CMMN)

### CMMN 1102. Public Speaking. (4 Hours)

Seeks to provide students with the tools necessary to plan and deliver a professional speech and with opportunities to practice and perfect their own presentation styles. Discusses common issues in public speaking, such as anxiety, audience analysis, and selecting a topic. Covers organizing a speech and developing effective introductions and conclusions. Explores methods of delivery and presentation aids. Exposes students to different types of speeches, both inside and outside of academia.

**Corequisite(s):** CMMN 1103

## Complex Networks (CNET)

### CNET 1990. Elective. (4 Hours)

Offers elective credit for courses taken at other academic institutions.

### CNET 2990. Elective. (4 Hours)

Offers elective credit for courses taken at other academic institutions.

### CNET 3990. Elective. (4 Hours)

Offers elective credit for courses taken at other academic institutions.

### CNET 4990. Elective. (4 Hours)

Offers elective credit for courses taken at other academic institutions.

### CNET 5050. Fundamentals of Complex Networks. (4 Hours)

Presents an interdisciplinary introduction to the science of complex networks and the starting point for students looking to develop an expertise in network science. Explores the mathematical foundation of networks (graph theory) and examines common tools for describing and analyzing networks. Discovers the origin of complex networks throughout our world, examining properties such as the degree distribution, centrality measures, path lengths, clustering, homophily, and robustness. Investigates evolving networks, growing networks, and network null models. Introduces common applications of network science in a variety of domains including biology, medicine, sociology, technology, and finance. Requires students to conduct their own analysis of a real network dataset of their choosing as part of the final project.

### CNET 5051. Analyzing Complex Network Data. (4 Hours)

Presents an overview of the core data scientific skills required to analyze complex networks. Through hands-on lectures, labs, and projects, exercises actionable skills about network analysis techniques using Python (in particular, the NetworkX library). Covers the basics of network analysis including data input/output, network statistics, and visualization. Explores instruction in random graph models and algorithms for computing network properties such as path lengths, clustering, degree distributions, and community structure. Offers students an opportunity to develop web scraping skills and introduces the vast landscape of software tools for analyzing complex networks. Concludes with a large-scale final project to demonstrate proficiency in network analysis.

### CNET 5052. Advanced Tools for Complex Network Analysis. (4 Hours)

Delves into more advanced techniques for analyzing large, complex networks such as filtering, backboning, and embedding. Demonstrates how the presence of extra network features, such as a temporal dimension, requires more advanced and computationally demanding techniques. Presents a more formal treatment of network generative models, such as the stochastic block model; exponential random graphs with particular focus on sampling from such models; and the basics of network reconstruction involving appropriate statistical/inference methods.

**Prerequisite(s):** CNET 5051 with a minimum grade of C

**CNET 5126. Spreading on Networks: From Epidemics to Memes. (4 Hours)**

Explores fundamentals of contagion on networks, starting with simple disease dynamics in mean field systems and building to spreading processes on complex networks. Examines a variety of contagion modeling techniques, which include state-of-the-art techniques for using networks to forecast the trajectory of an infectious disease, the emergence of a best-seller, predicting elections, or even modeling cascading failures in infrastructure networks. Introduces a diverse range of datasets and case studies, which students may draw from for their final modeling/analysis project. From biological pathogens like SARS-CoV-2, Ebola, and influenza to social contagions like fake news, memes, and influencers, complex network analysis gives us powerful tools to understand contagion processes in our modern world.

**Prerequisite(s):** CNET 5050 with a minimum grade of C ; CNET 5051 with a minimum grade of C

**CNET 5311. Physical and Digital Human Traces. (3 Hours)**

Examines how to use physical and digital human traces to understand how people interact with each other and their environment to gain fresh insights into human behavior. These traces can be captured from data sources such as mobile phones, social media posts, smart sensors, and transportation networks. The unprecedented availability of these data traces enables us to delve into theoretical and practical aspects of spatiotemporal data analysis techniques to characterize human behaviors. Studies technical proficiency required for investigating human dynamics to identify factors that determine how humans interact in physical spaces. Examines data science and statistical methods commonly employed in urban analytics to offer students an opportunity to obtain a robust comprehension of the methodologies, models, and data pertinent to study human dynamics.

**Prerequisite(s):** CNET 5050 with a minimum grade of C ; INSH 5301 with a minimum grade of C

**CNET 5314. Complexity in Social Systems. (3 Hours)**

Offers an in-depth exploration of complex systems and networks. Emphasizes the modeling of social phenomena using physical models. Focuses on quantitative phenomenology to understand and describe emergent features observed in large-scale social phenomena. Aims to identify general behavioral classes, not based on microscopic definitions but on universal, large-scale characteristics. This approach is used to uncover mechanisms behind various social dynamics such as opinion consensus, cultural dissemination, collective motion, and social hierarchies. Examines a range of contagion phenomena, from biological disease spread to social and technological contagions, highlighting the impact of complexity inherent in social, biological, and cultural aspects on these propagation processes.

**Prerequisite(s):** CNET 5050 with a minimum grade of C

**CNET 5360. Research Design for Social Networks. (4 Hours)**

Presents an in-depth exploration of experimental design in the context of social network analysis and a guide to the craft of research. Explores the knowledge and skills necessary to design and implement experiments that investigate social phenomena through the lens of network structures and dynamics. Every study is the result of a myriad of choices: What are the compelling questions and what data are needed to answer them? What exactly should you measure and how do you collect that data? What are the best ways to analyze these data? Considers digital trace, survey, qualitative data, and ethical considerations for each choice. Offers students an opportunity to develop a solid foundation in both social network analysis principles and experimental research methodologies.

**Prerequisite(s):** INSH 5301 with a minimum grade of C

**CNET 5411. Financial and Economic Networks. (3 Hours)**

Identifies the complex web of financial and economic interactions that shape our global economy. Examines a wide range of relevant and emerging topics of today's interconnected world and approaches to studying these networks. Investigates the integration of techniques, applications, and the impact of network theory in these fields. Explores in-depth three main topics: trade, financial, and socioeconomic networks. Delves into network models of trade, leveraging input-output data to understand production, as well as firm-level supply chain analysis. Considers topics of finance, including banking and online systems, as well as financial transactions. Draws insights into microeconomic topics of knowledge creation, the labor market, and income inequality.

**Prerequisite(s):** CNET 5050 with a minimum grade of C

**CNET 5515. Complex Network Analysis for Biological Systems. (4 Hours)**

Covers the properties of diverse biological networks and foundational computational methods for analyzing, visualizing, and performing statistical investigations of networked data. Investigates how physicists have uncovered remarkable regularities in networked systems by applying approaches from scaling theory to biological networks. Explores the diversity of biological networks and provides the foundational tools needed to study networks derived from real-world data, including tools from machine learning. Focusing on a series of case studies, studies how to elucidate the structure and function of biological networks using empirical data.

**Prerequisite(s):** CNET 5050 with a minimum grade of C ; CNET 5051 with a minimum grade of C

**CNET 5901. Visualizing Complex Networks. (2 Hours)**

Studies the knowledge and skills necessary to effectively visualize complex network data. Covers foundational principles of network data visualization and effective strategies to present core network properties to a range of different audiences. Offers students an opportunity to obtain experience using various network visualization tools such as Networkx and matplotlib, Gephi, and other web-based tools. Examines case studies to explore diverse network visualization approaches to effectively convey scientific insights, advance policy, and inform the public, including examples from such diverse fields as brain science, supply chains, epidemiology, and urban analytics. Students give and receive feedback, collectively building competency in how to create and interpret visualizations of complex data. Final projects are designed to prepare students for working with clients and collaborators from industry, nonprofits, government agencies, and research.

**Prerequisite(s):** CNET 5050 with a minimum grade of C ; CNET 5051 with a minimum grade of C

**CNET 5902. Communicating Network Data. (2 Hours)**

Examines critical aspects of conveying complex network data effectively and ethically. Explores not only how to simplify and articulate complex network concepts to various audiences but also grapples with the ethical implications of the work, ensuring that communication is not just effective but also responsible and legally compliant. This is done through a combination of lectures and reading, as well as through guest lecturers and case studies. Requires a final project presentation that is based on a previous project selected by the student and that offers new presentations of the material designed for two (imagined) audiences: a general audience and a technically trained audience. Designed to help students bridge the gap between technical network analysis and effective, ethical communication.

**Prerequisite(s):** CNET 5051 with a minimum grade of C

**CNET 6000. Professional Development for Co-op. (1 Hour)**

Introduces the cooperative education program. Offers students an opportunity to develop job-search and career-management skills; to assess their workplace skills, interests, and values and to discuss how they impact personal career choices; to prepare a professional resumé; and to learn proper interviewing techniques. Explores career paths, choices, professional behaviors, work culture, and career decision making.

**CNET 6061. Analyzing Higher-Order Networks. (2 Hours)**

Delves into specialized network structures including temporal networks, higher-order networks (such as simplicial complexes and hypergraphs), and multilayer networks. Explores the dynamic aspects of temporal networks, the rich representation of relationships in higher-order networks, and the interconnected systems modeled by multilayer networks. By mastering the analysis and modeling of these advanced network structures, aims to equip students to address complex real-world challenges across various domains, ranging from epidemiology and social sciences to transportation planning and resilience analysis.

**Prerequisite(s):** CNET 5050 with a minimum grade of C ; CNET 5051 with a minimum grade of C

**CNET 6063. Probabilistic Mathematics of Networks. (2 Hours)**

Introduces advanced probabilistic tools and statistical methodologies within the realm of network science. Offers students an opportunity to obtain the skills needed to navigate and analyze the complexities and inherent uncertainties of networked systems. Introduces basic probabilistic computing with probability generating functions, the development of message-passing algorithms, and their various applications in the field of network science. Focuses primarily on modeling complex dynamical systems and tackling statistical inference problems using real-world network data, demonstrating the depth and versatility of these techniques.

**Prerequisite(s):** CNET 5050 with a minimum grade of C ; INSH 5301 with a minimum grade of C

**CNET 6099. Special Topics in Complex Networks. (2 Hours)**

Delves into advanced and specialized topics within the interdisciplinary field of network science. Network science explores the structure, behavior, and dynamics of complex systems represented as networks, encompassing social, technological, biological, and physical systems. Examines in-depth cutting-edge research, theoretical frameworks, and practical applications to offer students an opportunity to obtain a deeper understanding of the current trends and challenges in network science.

**Prerequisite(s):** CNET 5050 with a minimum grade of C ; CNET 5052 with a minimum grade of C

**CNET 6107. Complex Network Analysis Research Rotation. (2 Hours)**

Offers students up to three lab rotations and self-directed exploration of how network science can model social, technical, physical, and epidemiological systems and solve applied societal problems. Diverse topics could include disease spreading, effects of public policies and health interventions, drug efficacy, improvement of health and security of human populations, science of success, shaping of social behavior, formulation of political beliefs, group decision making, geometry of networks, topological data analysis on graphs, anomaly detection, algorithmically infused societies, and unifying the physics of networks with the mining of graphs. After research rotations, students independently explore areas to apply their skill set and utilize research community to engage in outreach for workforce opportunities. May be repeated once.

**Prerequisite(s):** CNET 5050 with a minimum grade of C ; CNET 5051 with a minimum grade of C ; CNET 5052 with a minimum grade of C

**CNET 6108. Complex Network Analysis Capstone. (2 Hours)**

Offers students an opportunity to apply network analytic tools and network science concepts to a project that further develops skills and expands understanding of how to approach problems using network analytics and principles. Students may propose a topic or choose projects presented by a sponsoring organization or agency. Topics must be approved by the instructor, and students are expected to provide regular updates and present their final project. May be repeated once.

**Prerequisite(s):** CNET 5050 with a minimum grade of C ; CNET 5051 with a minimum grade of C ; CNET 5052 with a minimum grade of C

**CNET 6962. Elective. (4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**CNET 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated up to seven times.

**CNET 6990. Thesis. (2 Hours)**

Offers analytical, research, and/or experimental work conducted under the auspices of the department. May be repeated once.

**Prerequisite(s):** CNET 5050 with a minimum grade of B- ; CNET 5051 with a minimum grade of B- ; CNET 5052 with a minimum grade of B-

**Computer Engineering Technology - CPS (CET)****CET 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CET 2100. Essentials of Computer Organization. (3 Hours)**

Covers the structure and organization of computing systems. Topics include basic computer architecture, CPU and arithmetic-logic unit design, the datapath, input/output methods, memory management including caches and virtual memory, storage, instruction execution, assembly programming and assemblers, instruction formats, addressing modes, peripherals and interfacing, interrupts, and an introduction to operating systems and compilers.

**CET 2200. Data Structures and Algorithms. (3 Hours)**

Covers the design, analysis, and implementation of data structures and algorithms to solve engineering problems using an object-oriented programming language. Topics include elementary data structures (including arrays, stacks, queues, and lists); advanced data structures (including trees and graphs); the algorithms used to manipulate these structures; and their application to solving practical engineering problems.

**Prerequisite(s):** ALY 2100 with a minimum grade of D- or GET 2100 with a minimum grade of D- or ITC 2100 with a minimum grade of D-

**CET 2210. Industrial Robotics. (3 Hours)**

Introduces basic robotics concepts including frame geometry, coordinate systems, control systems, programming options, and safety procedures. Studies how to create, modify, and execute operational programs; recover from common program and robot faults; monitor, force, and simulate input and output signals; how to operate a teach pendant; and consider end-of-arm tooling.

**CET 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CET 3100. Computer Networking and Communications Technology. (3 Hours)**

Covers the technical foundation for designing, installing, maintaining, and monitoring computer networks. Covers technologies, protocols, and techniques used to connect computers to other computers and hardware components. Topics include the Open Systems Interconnection network model (OSI), internet protocols (TCP/IP), the User Datagram Protocol (UDP), Local Area Networks (LANs) and Wide Area Networks (WANs), wireless networks, network security, virtual private networking, and network management. Covers both circuit-switched and IP-based communications.

**Prerequisite(s):** CET 2100 with a minimum grade of D- ; GET 2100 with a minimum grade of D-

**CET 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CET 4210. Robotics. (3 Hours)**

Studies how to deploy robots in an existing manufacturing or processing environment. Examines how to design, integrate, and operate robots to improve productivity and safety. Offers students an opportunity to obtain an overall understanding of robotics from the point of view of the operator, technician, designer, and engineer. Reviews the history of robots, the various types of robots, and their applications. Robots rely on feedback from a variety of sensors, vision cameras, and other input devices to learn about their environment and react accordingly based on the system information. Investigates how mechanical, electrical, and software components all work together to perform a specific task.

**Prerequisite(s):** CET 2100 with a minimum grade of D- ; EET 3100 with a minimum grade of D- ; EET 3300 with a minimum grade of D-

**CET 4950. Seminar. (1-4 Hours)**

Offers an in-depth study of selected topics.

**CET 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**CET 4983. Topics. (1-4 Hours)**

Covers special topics in computer engineering technology. May be repeated without limit.

**CET 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CET 4991. Research. (1-4 Hours)**

Offers students an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**CET 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic.

**CET 4994. Internship. (1-4 Hours)**

Provides students with an opportunity for internship work.

**Attribute(s):** NUpath Integration Experience

**CET 4995. Practicum. (1-4 Hours)**

Provides eligible students with an opportunity for practical experience.

**CET 4996. Experiential Education Directed Study. (1-4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major.

**Attribute(s):** NUpath Integration Experience

## Computer Science (CS)

### **CS 1100. Computer Science and Its Applications. (4 Hours)**

Introduces students to the field of computer science and the patterns of thinking that enable them to become intelligent users of software tools in a problem-solving setting. Examines several important software applications so that students may develop the skills necessary to use computers effectively in their own disciplines.

**Corequisite(s):** CS 1101

**Attribute(s):** NUpath Analyzing/Using Data

### **CS 1101. Lab for CS 1100. (1 Hour)**

Accompanies CS 1100. Involves experiments and problem solving across multiple disciplines using computer science techniques and tools.

**Corequisite(s):** CS 1100

### **CS 1200. First Year Seminar. (1 Hour)**

Seeks to support students in their transition to Northeastern and in their holistic development as they become responsible members of the college and university communities. Incorporates large group discussion, small group activities, and self-reflection in order to facilitate connections with faculty, staff, and peers; promote utilization of appropriate campus resources; and assist with academic and personal goal setting.

### **CS 1210. Professional Development for Khouri Co-op. (1 Hour)**

Continues the preparation of students for careers in the computing and information fields by discussing co-op and co-op processes. Offers students an opportunity to prepare a professional resumé; practice proper interviewing techniques; explore current job opportunities; learn how to engage in the job and referral process; and to understand co-op policies, procedures, and expectations. Discusses professional behavior and ethical issues in the workplace.

**Prerequisite(s):** CS 2100 with a minimum grade of D- or CS 2510 with a minimum grade of D- or DS 2500 with a minimum grade of D-

### **CS 1800. Discrete Structures. (4 Hours)**

Introduces the mathematical structures and methods that form the foundation of computer science. Studies structures such as sets, tuples, sequences, lists, trees, and graphs. Discusses functions, relations, ordering, and equivalence relations. Examines inductive and recursive definitions of structures and functions. Discusses principles of proof such as truth tables, inductive proof, and basic logic. Also covers the counting techniques and arguments needed to estimate the size of sets, the growth of functions, and the space-time complexity of algorithms.

**Corequisite(s):** CS 1802

**Attribute(s):** NUpath Formal/Quant Reasoning

### **CS 1802. Seminar for CS 1800. (1 Hour)**

Accompanies CS 1800. Illustrates topics from the lecture course through discussions, quizzes, and homework assignments.

**Corequisite(s):** CS 1800

### **CS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **CS 2000. Introduction to Program Design and Implementation. (4 Hours)**

Introduces computer science and data science to students with no prior programming experience. Starts by building programs with numbers, text, and images. Explores real, complex datasets both interactively and through coding by doing data analysis, constructing graphs, and computing interesting results. Offers students an opportunity to build a solid foundation and practice coding with a popular industrial coding language with a professional programmer's interface to the code. Covers skills needed to identify and respond to ethical challenges that arise in the program design process.

**Corequisite(s):** CS 2001

**Attribute(s):** NUpath Formal/Quant Reasoning, NUpath Natural/Designed World

### **CS 2001. Lab for CS 2000. (1 Hour)**

Accompanies CS 2000. Covers topics from the course through various experiments.

**Corequisite(s):** CS 2000

**CS 2100. Program Design and Implementation 1. (4 Hours)**

Builds on prior introductory programming experience (from inside or outside Northeastern University) to examine the fundamentals of program design and implementation. Studies design of data- and object-oriented programs including common patterns; use of data structures; and underlying principles such as abstraction, encapsulation, inheritance, and interfaces. Introduces common software engineering practices such as test-driven development, version control, development environments, and good programming habits. Students practice using these design principles by writing medium-sized applications and using data science libraries. Covers skills needed to identify and respond to ethical challenges that arise in the program design process.

**Prerequisite(s):** CS 2000 with a minimum grade of D- or CS 2500 with a minimum grade of D-

**Corequisite(s):** CS 2101

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**CS 2101. Lab for CS 2100. (1 Hour)**

Accompanies CS 2100. Covers topics from the course through various experiments.

**Corequisite(s):** CS 2100

**CS 2386. Game Programming 1. (4 Hours)**

Introduces the different subsystems used to create a 3D game: rendering, animation, collision, physics, audio, trigger systems, game logic, and simple game artificial intelligence. Offers students an opportunity to learn the inner workings of game engines and how to use multiple libraries such as physics and graphics libraries to develop a game, while developing proficiency in a high-level game programming language. Discusses graphics pipeline, scene management, level design, and behavior scripting.

**Prerequisite(s):** ARTG 2260 with a minimum grade of D- or ARTG 2262 with a minimum grade of D- or CS 2000 with a minimum grade of D- or CS 2100 with a minimum grade of D- or CS 2500 with a minimum grade of D-

**CS 2484. Principles of Human-Computer Interaction. (4 Hours)**

Introduces the foundational principles of human-computer interaction. Presents an overview of the field, focusing on methods for designing, prototyping, and evaluating user interfaces for computing applications. Emphasizes a human-centered design approach, exploring topics such as human capabilities and social factors that influence interface use. Covers design methods, best practices for ensuring usability and accessibility, and usability evaluation techniques.

**CS 2501. Lab for CS 2500. (1 Hour)**

Accompanies CS 2500. Covers topics from the course through various experiments.

**Corequisite(s):** CS 2500

**CS 2800. Logic and Computation. (4 Hours)**

Introduces formal logic and its connections to computer and information science. Offers an opportunity to learn to translate statements about the behavior of computer programs into logical claims and to gain the ability to prove such assertions both by hand and using automated tools. Considers approaches to proving termination, correctness, and safety for programs. Discusses notations used in logic, propositional and first order logic, logical inference, mathematical induction, and structural induction. Introduces the use of logic for modeling the range of artifacts and phenomena that arise in computer and information science.

**Prerequisite(s):** (CS 1800 with a minimum grade of D- or MATH 1365 with a minimum grade of D- or MATH 2310 with a minimum grade of D- );  
(CS 2100 with a minimum grade of D- or CS 2500 with a minimum grade of D- )

**CS 2963. Topics. (1,2 Hours)**

Offers undergraduate students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering. May be repeated three times.

**CS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CS 2991. Research in Computer Science. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated three times.

**CS 2992. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**CS 3000. Algorithms and Data. (4 Hours)**

Introduces the basic principles and techniques for the design, analysis, and implementation of efficient algorithms and data representations. Discusses asymptotic analysis and formal methods for establishing the correctness of algorithms. Considers divide-and-conquer algorithms, graph traversal algorithms, and optimization techniques. Introduces information theory and covers the fundamental structures for representing data. Examines flat and hierarchical representations, dynamic data representations, and data compression. Concludes with a discussion of the relationship of the topics in this course to complexity theory and the notion of the hardness of problems.

**Prerequisite(s):** ((CS 2100 with a minimum grade of D- or CS 2510 with a minimum grade of D- or DS 2500 with a minimum grade of D- ); (CS 1800 with a minimum grade of D- or EECE 2160 with a minimum grade of D- ))

**Corequisite(s):** CS 3001

**Attribute(s):** NUpath Formal/Quant Reasoning

**CS 3001. Recitation for CS 3000. (0 Hours)**

Accompanies CS 3000. Provides students with additional opportunities to ask questions and engage with course material.

**Corequisite(s):** CS 3000

**CS 3100. Program Design and Implementation 2. (4 Hours)**

Builds on foundations introduced in CS 2100 to examine program design at increasing scales of complexity. Reviews abstraction, encapsulation, inheritance, and interfaces in statically typed object-oriented languages. Presents a comparative approach to software design patterns and paradigms, including object-oriented and functional programming. Offers students an opportunity to obtain a deeper understanding of the principles of program design including interface design, test-driven development, graphical design notations, reusable software components, and open-source ecosystems. Illustrates the impact of design-time decisions on software correctness including accessibility, changeability, performance, reusability, and privacy. Students collaborate throughout the semester to design and implement a large software project.

**Prerequisite(s):** CS 2100 with a minimum grade of D- or CS 2510 with a minimum grade of D- or EECE 2560 with a minimum grade of D-

**Corequisite(s):** CS 3101

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**CS 3101. Lab for CS 3100. (1 Hour)**

Accompanies CS 3100. Covers topics from the course and provides students with additional opportunities to engage with course material.

**Corequisite(s):** CS 3100

**CS 3200. Introduction to Databases. (4 Hours)**

Studies the design of a database for use in a relational database management system. The entity-relationship model and normalization are used in problems. Relational algebra and then the SQL (structured query language) are presented. Advanced topics include triggers, stored procedures, indexing, elementary query optimization, and fundamentals of concurrency and recovery. Students implement a database schema and short application programs on one or more commercial relational database management systems.

**Prerequisite(s):** CS 2000 with a minimum grade of D- or CS 2100 with a minimum grade of D- or CS 2500 with a minimum grade of D- or DS 2000 with a minimum grade of D- or DS 2500 with a minimum grade of D- or EECE 2560 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**CS 3386. Game Programming 2. (4 Hours)**

Covers advanced concepts and techniques for developing high-performance, professional-quality 3D games using a modern game engine such as Unity3D. Building on foundational game programming skills, provides an opportunity to dive deeper into topics such as advanced physics systems, dynamic asset management, game data storage solutions, networking architectures and APIs for multiplayer games, advanced rendering techniques, and performance optimization. Offers opportunity to implement advanced game mechanics, persistent data storage, integrate telemetry for player analytics, and develop custom tools to streamline game development workflows. Presents skills necessary to tackle complex game development challenges and deliver polished, optimized games for various platforms.

**Prerequisite(s):** (CS 2100 with a minimum grade of D- or CS 2510 with a minimum grade of D- ); (CS 2386 with a minimum grade of D- or CS 3540 with a minimum grade of D- )

**CS 3484. GUI Programming. (4 Hours)**

Focuses on the implementation of usable graphical user interfaces using object-oriented design principles. Demonstrates how to build interactive and responsive applications while focusing on the usability of GUIs. Covers fundamental concepts of GUI programming including event-driven programming, layout management, and state handling. Demonstrates how to develop proficiency in a modern GUI framework.

**Prerequisite(s):** CS 2100 with a minimum grade of D- or CS 2510 with a minimum grade of D-

**Attribute(s):** NUpath Writing Intensive

**CS 3520. Programming in C++. (4 Hours)**

Examines how to program in C++ in a robust and safe manner. Reviews basics, including scoping, typing, and primitive data structures. Discusses data types (primitive, array, structure, class, string); addressing/parameter mechanisms (value, pointer, reference); stacks; queues; linked lists; binary trees; hash tables; and the design of classes and class inheritance, emphasizing single inheritance. Considers the instantiation of objects, the trade-offs of stack vs. heap allocation, and the design of constructors and destructors. Emphasizes the need for a strategy for dynamic memory management. Addresses function and operator overloading; templates, the Standard Template Library (STL), and the STL components (containers, generic algorithms, iterators, adaptors, allocators, function objects); streams; exception handling; and system calls for processes and threads.

**Prerequisite(s):** CS 2100 with a minimum grade of D- or CS 2510 with a minimum grade of D- or DS 2500 with a minimum grade of D-

**CS 3620. Building Extensible Systems. (4 Hours)**

Deals with the design of extensible software systems, which enable clients to add functionality both statically as well as dynamically. Examples of such systems are operating systems, game servers, and Web browsers. Describes the classic systems built on C-like languages with unsafe, manual memory control and the more recent systems built on Java-like languages with safe, automated memory management. Introduces the Rust programming language, which combines the efficiency of C with safe manual memory control via type specifications and compiler constraints. Offers students an opportunity to build systems using all three settings but focuses on the Rust approach. Students also have an opportunity to evaluate their work via essays and memos.

**Prerequisite(s):** (CS 2100 with a minimum grade of D- or CS 2510 with a minimum grade of D-); (ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C)

**Attribute(s):** NUpath Writing Intensive

**CS 3650. Computer Systems. (4 Hours)**

Introduces the basic design of computing systems, computer operating systems, and assembly language using a RISC architecture. Describes caches and virtual memory. Covers the interface between assembly language and high-level languages, including call frames and pointers. Covers the use of system calls and systems programming to show the interaction with the operating system. Covers the basic structures of an operating system, including application interfaces, processes, threads, synchronization, interprocess communication, deadlock, memory management, file systems, and input/output control.

**Prerequisite(s):** CS 2510 with a minimum grade of D- or CS 3100 with a minimum grade of D- or EECE 2560 with a minimum grade of D-

**CS 3700. Networks and Distributed Systems. (4 Hours)**

Introduces the fundamentals of computer networks, including network architectures, network topologies, network protocols, layering concepts (for example, ISO/OSI, TCP/IP reference models), communication paradigms (point-to-point vs. multicast/broadcast, connectionless vs. connection oriented), and networking APIs (sockets). Also covers the construction of distributed programs, with an emphasis on high-level protocols and distributed state sharing. Topics include design patterns, transactions, performance trade-offs, security implications, and reliability. Uses examples from real networks (TCP/IP, Ethernet, 802.11) and distributed systems (Web, BitTorrent, DNS) to reinforce concepts.

**Prerequisite(s):** CS 2510 with a minimum grade of D-

**CS 3800. Theory of Computation. (4 Hours)**

Introduces the theory behind computers and computing aimed at answering the question, "What are the capabilities and limitations of computers?" Covers automata theory, computability, and complexity. The automata theory portion includes finite automata, regular expressions, nondeterminism, nonregular languages, context-free languages, pushdown automata, and noncontext-free languages. The computability portion includes Turing machines, the Church-Turing thesis, decidable languages, and the Halting theorem. The complexity portion includes big-O and small-o notation, the classes P and NP, the P vs. NP question, and NP-completeness.

**Prerequisite(s):** CS 2100 with a minimum grade of D- or CS 2510 with a minimum grade of D- or EECE 2160 with a minimum grade of D-

**CS 3950. Introduction to Computer Science Research. (2 Hours)**

Introduces students to research in the fields of computer science, information science, data science, and cybersecurity. Explores how the scientific method is applied to these fields and covers the breadth of subareas of specialty that exist. Offers students an opportunity to practice how to locate and read scientific literature in different subareas. Also offers students an overview of graduate education in these fields.

**CS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CS 4050. Artificial Intelligence and Society. (4 Hours)**

Examines the societal impact of artificial intelligence technologies and prominent strategies for aligning these impacts with social and ethical values. Offers multidisciplinary readings to provide conceptual lenses for understanding these technologies in their contexts of use.

**CS 4097. Mixed Reality. (4 Hours)**

Seeks to provide a strong foundation in the fundamentals of virtual and augmented reality, broadly defined as mixed reality (XR). These technologies have recently witnessed a resurgence of interest. Offers students an opportunity to obtain hands-on experience developing XR applications by diving into this burgeoning area of research and practice in computer science. Synthesizes theoretical and practice knowledge from various disciplines, including computer graphics, 3D interfaces, human-computer interaction, tracking systems, and perceptual psychology.

**Prerequisite(s):** CS 3540 with a minimum grade of D-

**CS 4100. Artificial Intelligence. (4 Hours)**

Introduces the fundamental problems, theories, and algorithms of the artificial intelligence field. Includes heuristic search; knowledge representation using predicate calculus; automated deduction and its applications; planning; and machine learning. Additional topics include game playing; uncertain reasoning and expert systems; natural language processing; logic for common-sense reasoning; ontologies; and multiagent systems.

**Prerequisite(s):** CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- or DS 3500 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CS 4120. Natural Language Processing. (4 Hours)**

Introduces the computational modeling of human language; the ongoing effort to create computer programs that can communicate with people in natural language; and current applications of the natural language field, such as automated document classification, intelligent query processing, and information extraction. Topics include computational models of grammar and automatic parsing, statistical language models and the analysis of large text corpora, natural language semantics and programs that understand language, models of discourse structure, and language use by intelligent agents. Course work includes formal and mathematical analysis of language models and implementation of working programs that analyze and interpret natural language text. Knowledge of statistics is helpful.

**Prerequisite(s):** CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- or DS 3500 with a minimum grade of D-

**CS 4130. Engineering LLM-Integrated Systems. (4 Hours)**

Studies the software engineering foundations for systems that integrate large language models (LLMs). Examines how LLM-integrated systems turn natural language instructions into actions. Offers opportunities to build systems with natural and fluid interfaces, integrate them with existing software, rigorously test their behavior, and understand their failure modes and limitations.

**Prerequisite(s):** CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- or DS 3500 with a minimum grade of D-

**CS 4150. Game Artificial Intelligence. (4 Hours)**

Offers an overview of classical and modern approaches to artificial intelligence in digital games. Focuses on the creation of believable agents and environments with the goal of providing a fun and engaging experience to a player. Covers player modeling, procedural content generation, behavior trees, interactive narrative, decision-making systems, cognitive modeling, and path planning. Explores different approaches for behavior generation, including learning and rule-based systems. Requires students to complete several individual assignments in these areas to apply the concepts covered in class. Students choose a group final project to explore one aspect of artificial intelligence for games in further depth. Offers students an opportunity to learn team management and communication. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** (CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- ); CS 3520 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CS 4180. Reinforcement Learning. (4 Hours)**

Introduces reinforcement learning and the Markov decision process (MDP) framework. Covers methods for planning and learning in MDPs such as dynamic programming, model-based methods, and model-free methods. Examines commonly used representations including deep-learning representations. Students are expected to have a working knowledge of probability, to complete programming assignments, and to complete a course project that applies some form of reinforcement learning to a problem of interest.

**Prerequisite(s):** CS 3000 with a minimum grade of D- ; (ECON 2350 with a minimum grade of D- or CS 2810 with a minimum grade of D- or DS 3000 with a minimum grade of D- or ENVR 2500 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (CS 2810 with a minimum grade of D- or DS 3000 with a minimum grade of D- or MATH 2331 with a minimum grade of D- )

**CS 4220. Information Retrieval. (4 Hours)**

Introduces information retrieval (IR) systems and different approaches to IR. Topics covered include evaluation of IR systems; retrieval, language, and indexing models; file organization; compression; relevance feedback; clustering; distributed retrieval and metasearch; probabilistic approaches to IR; Web retrieval; filtering, collaborative filtering, and recommendation systems; cross-language IR; multimedia IR; and machine learning for IR.

**Prerequisite(s):** (CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- or DS 3500 with a minimum grade of D- ); (CS 2810 with a minimum grade of D- or DS 3000 with a minimum grade of D- or ECON 2350 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- )

**CS 4300. Computer Graphics. (4 Hours)**

Charts a path through every major aspect of computer graphics with varying degrees of emphasis. Discusses hardware issues: size and speed; lines, polygons, and regions; modeling, or objects and their relations; viewing, or what can be seen (visibility and perspective); rendering, or how it looks (properties of surfaces, light, and color); transformations, or moving, placing, distorting, and animating and interaction, or drawing, selecting, and transforming.

**Prerequisite(s):** (CS 2510 with a minimum grade of D- or CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- or EECE 2560 with a minimum grade of D- ); (CS 2810 with a minimum grade of D- or DS 3000 with a minimum grade of D- or MATH 1260 with a minimum grade of D- or MATH 2331 with a minimum grade of D- or MATH 2341 with a minimum grade of D- )

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CS 4350. Empirical Research Methods. (4 Hours)**

Evaluates and conducts empirical research, focusing on students' use of empirical methods to study the effectiveness and organizational/social impact of information systems and technologies. Empirical research involves a number of broad steps including identifying problems; developing specific hypotheses; collecting data relevant to the hypotheses; analyzing the data; and considering alternative explanations for the empirical findings. Some of the most commonly used research techniques, such as surveys, experiments, and ethnographic methods, are discussed. Additional topics include the ethics of data collection and experimentation in behavioral science. Although the course focuses primarily on the relationship between formulating research questions and implementing the appropriate methods to answer them, students can expect to apply the statistical techniques learned in the course prerequisites.

**Prerequisite(s):** CS 2810 with a minimum grade of D- or DS 3000 with a minimum grade of D- or ECON 2350 with a minimum grade of D- or ENVR 2500 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PHTH 2210 with a minimum grade of D- or PSYC 2320 with a minimum grade of D-

**CS 4360. Non-Interactive Computer Graphics. (4 Hours)**

Introduces computer graphics algorithms and concepts primarily focusing on offline rendering techniques. Consists of a lecture component and in-class laboratory to study common image synthesis algorithms and techniques to generate images used in games and 3D animated movies. Culminates with a final project in which students complete in groups or individually a renderer for generating high quality images. Students with an interest in a career as a graphics, rendering, or high performance computer engineer may consider taking this course.

**Prerequisite(s):** (CS 2810 with a minimum grade of D- or DS 3000 with a minimum grade of D- or MATH 2331 with a minimum grade of D- ); (CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- )

**CS 4400. Programming Languages. (4 Hours)**

Introduces a systematic approach to understanding the behavior of programming languages. Covers interpreters; static and dynamic scope; environments; binding and assignment; functions and recursion; parameter-passing and method dispatch; objects, classes, inheritance, and polymorphism; type rules and type checking; and concurrency.

**Prerequisite(s):** (CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- ); (CS 3000 with a minimum grade of D- or CS 4800 with a minimum grade of D- )

**CS 4410. Compilers. (4 Hours)**

Studies the construction of compilers and integrates material from earlier courses on programming languages, automata theory, computer architecture, and software design. Examines syntax trees; static semantics; type checking; typical machine architectures and their software structures; code generation; lexical analysis; and parsing techniques. Uses a hands-on approach with a substantial term project.

**Prerequisite(s):** CS 4400 with a minimum grade of D- or CS 5400 with a minimum grade of C- or CS 7400 with a minimum grade of C-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CS 4500. Software Development. (4 Hours)**

Considers software development as a systematic process involving specification, design, documentation, implementation, testing, and maintenance. Examines software process models; methods for software specification; modularity, abstraction, and software reuse; and issues of software quality. Students, possibly working in groups, design, document, implement, test, and modify software projects.

**Prerequisite(s):** (CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D-); (ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C)

**Attribute(s):** NUpath Writing Intensive

**CS 4520. Mobile Application Development. (4 Hours)**

Focuses on mobile application development on a mobile phone or related platform. Discusses memory management; user interface building, including both MVC principles and specific tools; touch events; data handling, including core data, SQL, XML, and JSON; network techniques and URL loading; and, finally, specifics such as GPS and motion sensing that may be dependent on the particular mobile platform. Students are expected to work on a project that produces a professional-quality mobile application. The instructor chooses a modern mobile platform to be used in the course.

**Prerequisite(s):** CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D-

**CS 4530. Fundamentals of Software Engineering. (4 Hours)**

Covers the fundamentals of software engineering, including software development life cycle models (e.g., waterfall, spiral, agile); requirements analysis; user-centered design; software design principles and patterns; testing (functional testing, structural testing, testing strategies); code refactoring and debugging; software architecture and design; and integration and deployment. Includes a course project in which some of the software engineering methods (from requirements analysis to testing) are applied in a team-based setting.

**Prerequisite(s):** CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CS 4535. Professional Practicum Capstone. (4 Hours)**

Offers students an opportunity to expand skills in real-world application development and team collaboration within an experiential learning structure. Involves students in industry-specific projects designed to integrate into an industry partner's intellectual property portfolio. Projects focus on software design and development and also include written components that align with the partner's standards and reference relevant prior work. Students engage in a structured process of milestones and feedback cycles with peers; instructors; and, as appropriate, industry partners to refine project outcomes.

**Attribute(s):** NUpath Capstone Experience, NUpath Integration Experience, NUpath Writing Intensive

**CS 4550. Web Development. (4 Hours)**

Discusses Web development for sites that are dynamic, data driven, and interactive. Focuses on the software development issues of integrating multiple languages, assorted data technologies, and Web interaction. Considers ASP.NET, C#, HTTP, HTML, CSS, XML, XSLT, JavaScript, AJAX, RSS/Atom, SQL, and Web services. Requires each student to deploy individually designed Web experiments that illustrate the Web technologies and at least one major integrative Web site project. Students may work as a team with the permission of the instructor. Each student or team must also create extensive documentation of their goals, plans, design decisions, accomplishments, and user guidelines. All source files must be open and be automatically served by a sources server.

**Prerequisite(s):** CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- or DS 3500 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CS 4610. Robotic Science and Systems. (4 Hours)**

Introduces autonomous mobile robots, with a focus on algorithms and software development, including closed-loop control, robot software architecture, wheeled locomotion and navigation, tactile and basic visual sensing, obstacle detection and avoidance, and grasping and manipulation of objects. Offers students an opportunity to progressively construct mobile robots from a predesigned electromechanical kit. The robots are controlled wirelessly by software of the students' own design, built within a provided robotics software framework. The course culminates in a grand challenge competition using all features of the robots.

**Prerequisite(s):** CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D-

**CS 4700. Network Fundamentals. (4 Hours)**

Introduces the fundamental concepts of network protocols and network architectures. Presents the different harmonizing functions needed for the communication and effective operation of computer networks. Provides in-depth coverage of data link control, medium access control, routing, end-to-end transport protocols, congestion and flow control, multicasting, naming, auto configuration, quality of service, and network management. Studies the abstract mechanisms and algorithms as implemented in real-world Internet protocols. Also covers the most common application protocols (e-mail, Web, and ftp).

**Prerequisite(s):** CS 3650 with a minimum grade of D- or CS 5600 with a minimum grade of D- or CS 5600 with a minimum grade of C- (Graduate)

**CS 4730. Distributed Systems. (4 Hours)**

Introduces distributed systems, covering fundamental concepts and showing how they are applied to build reliable distributed services. Examines several existing distributed applications, such as file systems, databases, lock services, digital currencies, smart contracts, and machine learning, and how these applications must coordinate to function and overcome failures, network partitions, or compromised parties. Distributed systems, such as databases, cloud services, and blockchains, are omnipresent in the services and applications that serve society on a daily basis.

**Prerequisite(s):** CS 3650 with a minimum grade of D-

**CS 4805. Fundamentals of Complexity Theory. (4 Hours)**

Reviews basic material such as automata, Turing machines, (un)decidability, time complexity, P vs. NP, and NP-completeness. Studies core topics in computational complexity, including time and space complexity, polynomial hierarchy, circuit complexity, probabilistic computation, interactive proofs, and hardness of approximation. Optional topics may include Gödel's incompleteness theorem, Kolmogorov complexity, cryptography, quantum computing, communication complexity, lower bounds, or pseudorandomness.

**Prerequisite(s):** CS 3800 with a minimum grade of D-

**CS 4810. Advanced Algorithms. (4 Hours)**

Builds on CS 3000. Presents an advanced study of computer algorithms. Covers basic algorithmic paradigms (e.g., greedy, divide-and-conquer, and dynamic programming); graph algorithms; optimization; computational Intractability (e.g., NP-completeness, PSPACE-completeness); randomized algorithms; and approximation algorithms.

**Prerequisite(s):** CS 3000 with a minimum grade of D-

**CS 4820. Computer-Aided Reasoning. (4 Hours)**

Covers fundamental concepts, techniques, and algorithms in computer-aided reasoning, including propositional logic, variants of the DPLL algorithm for satisfiability checking, first-order logic, unification, tableaux, resolution, Horn clauses, congruence closure, rewriting, Knuth-Bendix completion, decision procedures, Satisfiability Modulo Theories, recursion, induction, termination, Presburger arithmetic, quantifier elimination, and interactive theorem proving. Offers students an opportunity to develop and implement a reasoning engine in a sequence of projects over the course of the semester. Also covers how to formalize and reason about computational systems using a modern interactive theorem prover.

**Prerequisite(s):** CS 2800 with a minimum grade of D- ; CS 3000 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience

**CS 4830. System Specification, Verification, and Synthesis. (4 Hours)**

Covers the fundamental topics in formal modeling and specification (transition systems, temporal logic, regular and omega-regular languages, safety and liveness properties, etc.); computer-aided verification (state-space exploration, model checking, bounded-model checking, binary-decision diagrams, symbolic model checking, etc.); compositionality and assume-guarantee reasoning; contracts; and component-based design. Also covers fundamental topics in computer-aided synthesis of correct-by-construction systems, starting from high-level formal specifications or from example scenarios. Designing large and complex systems (digital circuits, embedded control systems such as automated vehicles, computerized healthcare devices such as pacemakers, cyber-physical systems such as automated intersections, etc.) and their software cannot be done by hand. Instead, designers use computer-aided techniques that allow them to build system models and verify correctness of the design before the real system is actually built.

**Prerequisite(s):** CS 3000 with a minimum grade of D-

**CS 4850. Building Game Engines. (4 Hours)**

Discusses the components of game engines and strategies for their software implementation. Includes graphics management algorithms (animation, scene graph, level of detail); basic artificial intelligence algorithms (search, decision making, sensing); and related algorithmic issues (networking, threading, input processing). Explores the use of data-driven software design. Offers students an opportunity to use a rendering engine and to build and integrate several software components to create a complete game engine. Requires students to work on several individual assignments to apply the algorithms and then develop a project in a team. Offers students an opportunity to learn team/project management; work division; team communication; and the software development cycle of implementation, testing, critique, and further iteration. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** CS 3520 with a minimum grade of D- ; CS 3540 with a minimum grade of D-

**CS 4950. Computer Science Research Seminar. (1 Hour)**

Offers students an in-depth look at research in a particular subarea of computer science, information science, data science, or cybersecurity. The particular subarea varies from semester to semester. Exposes students to current research topics, often via guest faculty members. Offers students an opportunity to practice reading and discussing scientific literature, presenting scientific work, and distilling the key ideas and contributions of papers through required weekly paper summaries. May be repeated once.

**Prerequisite(s):** CS 3950 with a minimum grade of D-

**CS 4955. Computer Science Teaching Seminar. (1 Hour)**

Introduces techniques and frameworks to prepare undergraduate students to become more effective teaching assistants in the field of computer science. Students analyze and reflect on literature, case studies, and real examples of teaching computer science. Offers students an opportunity to participate within in-class activities to learn presentation skills, to practice speaking to different audience sizes, and to learn how to work with different types of audiences. Culminates with a final capstone project in which students prepare and present a lecture on a topic in computer science. Successful students are prepared for careers in teaching, presenting technical content when pursuing graduate studies, and for presenting technical information in industry.

**Prerequisite(s):** CS 2500 with a minimum grade of D-

**CS 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors in the discipline project.

**CS 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field.

**Prerequisite(s):** CS 4970 with a minimum grade of D-

**CS 4973. Topics in Computer Science. (4 Hours)**

Offers a lecture course in computer science on a topic not regularly taught in a formal course. Topics may vary from offering to offering. May be repeated up to three times.

**Prerequisite(s):** CS 3000 with a minimum grade of D- ; (CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- or DS 3500 with a minimum grade of D- )

**CS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CS 4991. Research. (4,8 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated up to three times.

**Prerequisite(s):** (CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- ); CS 3800 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Integration Experience, NUpath Writing Intensive

**CS 4992. Directed Study. (1-6 Hours)**

Focuses on student examining standard computer science material in fresh ways or new computer science material that is not covered in formal courses. May be repeated up to three times.

**Prerequisite(s):** (CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- ); CS 3800 with a minimum grade of D-

**CS 4998. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**CS 5001. Intensive Foundations of Computer Science. (4 Hours)**

Introduces systematic problem solving through programming. Offers students an opportunity to learn how to analyze a problem, how to divide and organize the problem into appropriate components, how to describe the problem in a computer language, how to analyze and understand the behavior of their programs, and how to test that their programs are working correctly. Additionally, introduces a method of program design called object-oriented programming and various ways to organize data, including a discussion of their advantages and disadvantages. To practice the course concepts, students undertake assignments ranging from small, highly specified programming tasks to larger open-ended problems where students design and code their own solutions.

**Corequisite(s):** CS 5003

**CS 5002. Discrete Structures. (4 Hours)**

Introduces the mathematical structures and methods that form the foundation of computer science. Studies structures such as sets, tuples, sequences, lists, trees, and graphs. Discusses functions, relations, ordering, and equivalence relations. Examines inductive and recursive definitions of structures and functions. Covers principles of proof such as truth tables, inductive proof, and basic logic and the counting techniques and arguments needed to estimate the size of sets, the growth of functions, and the space-time complexity of algorithms. Also, discusses data structures such as arrays, stacks, queues, lists, and the algorithms that manipulate them.

**CS 5003. Recitation for CS 5001. (0 Hours)**

Provides a small-group discussion format to cover material in CS 5001.

**Corequisite(s):** CS 5001

**CS 5004. Object-Oriented Design. (4 Hours)**

Presents a comparative approach to object-oriented programming and design. Discusses the concepts of object, class, metaclass, message, method, inheritance, and genericity. Reviews forms of polymorphism in object-oriented languages. Contrasts the use of inheritance and composition as dual techniques for software reuse-forwarding vs. delegation and subclassing vs. subtyping. Offers students an opportunity to obtain a deeper understanding of the principles of object-oriented programming and design, including software components, object-oriented design patterns, and the use of graphical design notations such as UML (unified modeling language). Illustrates basic concepts in object-oriented design with case studies in application frameworks and by writing programs in Java.

**Prerequisite(s):** (CS 5001 with a minimum grade of C- or CS 5001 with a minimum grade of C- ); (CS 5002 with a minimum grade of C- or CS 5002 with a minimum grade of C- )

**Corequisite(s):** CS 5005

**CS 5005. Recitation for CS 5004. (0 Hours)**

Provides small-group discussion format to cover material in CS 5004.

**Corequisite(s):** CS 5004

**CS 5008. Data Structures, Algorithms, and Their Applications within Computer Systems. (4 Hours)**

Presents an integrated approach to the study of data structures, algorithms, and their application within systems topics. Introduces a variety of fundamental algorithmic techniques (divide-and-conquer, dynamic programming, graph algorithms) and systems topics (models of computation, computer architecture, compilation, system software, networking). Demonstrates the integration of topics through programming assignments in the C language that implement fundamental data structures (lists, queues, trees, maps, graphs) and algorithms as they are applied in computer systems. Additional breadth topics include programming applications that expose students to primitives of different subsystems using threads and sockets.

**Prerequisite(s):** (CS 5001 with a minimum grade of C- or CS 5001 with a minimum grade of C- ); (CS 5002 with a minimum grade of C- or CS 5002 with a minimum grade of C- )

**Corequisite(s):** CS 5009

**CS 5009. Recitation for CS 5008. (0 Hours)**

Provides small-group active learning format to augment material in CS 5008.

**Corequisite(s):** CS 5008

**CS 5010. Programming Design Paradigm. (4 Hours)**

Introduces modern program design paradigms. Starts with functional program design, introducing the notion of a design recipe. The latter consists of two parts: a task organization (ranging from the description of data to the creation of a test suite) and a data-oriented approach to the organization of programs (ranging from atomic data to self-referential data definitions and functions as data). The course then progresses to object-oriented design, explaining how it generalizes and contrasts with functional design. In addition to studying program design, students also have an opportunity to practice pair-programming and public code review techniques, as found in industry today.

**Corequisite(s):** CS 5011

**CS 5011. Recitation for CS 5010. (0 Hours)**

Provides small-group discussion format to cover material in CS 5010.

**Corequisite(s):** CS 5010

**CS 5047. Exploring AI Trends and Tools. (4 Hours)**

Explores key ideas in artificial intelligence while delving into trending developments in the field. Examines AI tools and frameworks to enable collaboration effectively and efficiently across technical and nontechnical stakeholders. Analyzes topics such as AI-enabled perception, representation, reasoning, and learning as contextualized by societal impact. Offers students an opportunity to obtain the knowledge and skills necessary to confidently navigate the ever-evolving landscape of AI.

**CS 5097. Mixed Reality. (4 Hours)**

Seeks to provide a strong foundation in the fundamentals of virtual and augmented reality, broadly defined as mixed reality (XR), and hands-on experience developing XR applications. Offers students an opportunity to dive into this burgeoning area of research and practice in computer science. Given the complex nature of XR environments, this course synthesizes theoretical and practice knowledge from various disciplines, including computer graphics, 3D interfaces, human-computer interaction, tracking systems, and perceptual psychology (to name a few). XR technologies have recently witnessed a resurgence of interest.

**CS 5100. Foundations of Artificial Intelligence. (4 Hours)**

Introduces the fundamental problems, theories, and algorithms of the artificial intelligence field. Topics include heuristic search and game trees, knowledge representation using predicate calculus, automated deduction and its applications, problem solving and planning, and introduction to machine learning. Required course work includes the creation of working programs that solve problems, reason logically, and/or improve their own performance using techniques presented in the course.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CS 5130. Applied Programming and Data Processing for AI. (4 Hours)**

Presents an in-depth exploration of programming paradigms, mathematical foundations, and computational techniques essential for scientific computing and data-driven applications. Integrates linear algebra, Python programming principles, algorithmic design, and data science methodologies to offer students an opportunity to develop the technical expertise necessary for handling complex numerical computations and large-scale data processing. Strongly emphasizes Pythonic programming, object-oriented and functional programming, data preprocessing, visualization, and numerical stability, with the aim of developing the skills needed to write clean, efficient, and maintainable code for scientific and engineering applications.

**Corequisite(s):** CS 5131

**CS 5131. Recitation for CS 5130. (0 Hours)**

Provides small-group discussion format to cover material in CS 5130.

**Corequisite(s):** CS 5130

**CS 5150. Game Artificial Intelligence. (4 Hours)**

Offers an overview of classical and modern approaches to artificial intelligence in digital games. Focuses on the creation of believable agents and environments with the goal of providing a fun and engaging experience to a player. Covers player modeling, procedural content generation, behavior trees, interactive narrative, decision-making systems, cognitive modeling, and path planning. Explores different approaches for behavior generation, including learning and rule-based systems. Requires students to complete several individual assignments in these areas to apply the concepts covered in class. Students choose a group final project, which requires a report, to explore one aspect of artificial intelligence for games in further depth. Offers students an opportunity to learn team management and communication. Requires knowledge of algorithms and experience with object-oriented design or functional programming.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CS 5170. Artificial Intelligence for Human-Computer Interaction. (4 Hours)**

Offers an overview of the wide range of AI techniques that exploit knowledge of the domain and humans to facilitate interaction between humans and systems, mediate human-human interaction, leverage humans to improve system performance, and promote beneficial outcomes at the social and individual level. Topics can include AI/human computation, plan and activity recognition, smart sensing/homes, active learning, preference elicitation, intelligent/adaptive user interfaces, and mixed human-agent simulations. Studies how to design and develop intelligent interaction technologies while also critically assessing their social and ethical impact.

**Prerequisite(s):** CS 5100 with a minimum grade of C- ; CS 5800 with a minimum grade of C- ; CS 6140 with a minimum grade of C-

**CS 5180. Reinforcement Learning and Sequential Decision Making. (4 Hours)**

Introduces reinforcement learning and the underlying computational frameworks and the Markov decision process framework. Covers a variety of reinforcement learning algorithms, including model-based, model-free, value function, policy gradient, actor-critic, and Monte Carlo methods. Examines commonly used representations including deep learning representations and approaches to partially observable problems. Students are expected to have a working knowledge of probability and linear algebra, to complete programming assignments, and to complete a course project that applies some form of reinforcement learning to a problem of interest.

**CS 5200. Database Management Systems. (4 Hours)**

Introduces relational database management systems as a class of software systems. Prepares students to be sophisticated users of database management systems. Covers design theory, query language, and performance/tuning issues. Topics include relational algebra, SQL, stored procedures, user-defined functions, cursors, embedded SQL programs, client-server interfaces, entity-relationship diagrams, normalization, B-trees, concurrency, transactions, database security, constraints, object-relational DBMSs, and specialized engines such as spatial, text, XML conversion, and time series. Includes exercises using a commercial relational or object-relational database management system.

**Attribute(s):** NUpath Analyzing/Using Data

**CS 5310. Computer Graphics. (4 Hours)**

Introduces the fundamentals of two-dimensional and three-dimensional computer graphics, with an emphasis on approaches for obtaining realistic images. Covers two-dimensional algorithms for drawing lines and curves, anti-aliasing, filling, and clipping. Studies rendering of three-dimensional scenes composed of spheres, polygons, quadric surfaces, and bi-cubic surfaces using ray-tracing and radiosity. Includes techniques for adding texture to surfaces using texture and bump maps, noise, and turbulence. Requires knowledge of linear algebra.

**Prerequisite(s):** MATH 2331 with a minimum grade of D- or graduate program admission

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CS 5330. Pattern Recognition and Computer Vision. (4 Hours)**

Introduces fundamental techniques for low-level and high-level computer vision. Examines image formation, early processing, boundary detection, image segmentation, texture analysis, shape from shading, photometric stereo, motion analysis via optic flow, object modeling, shape description, and object recognition (classification). Discusses models of human vision (gestalt effects, texture perception, subjective contours, visual illusions, apparent motion, mental rotations, and cyclopean vision). Requires knowledge of linear algebra.

**Prerequisite(s):** MATH 2331 with a minimum grade of D- or graduate program admission

**CS 5335. Robotic Science and Systems. (4 Hours)**

Introduces autonomous mobile robots with a focus on algorithms and software development, including closed-loop control, robot software architecture, wheeled locomotion and navigation, tactile and basic visual sensing, obstacle detection and avoidance, and grasping and manipulation of objects. Offers students an opportunity to progressively construct mobile robots from a predesigned electromechanical kit. The robots are controlled wirelessly by software of the students' own design, built within a provided robotics software framework. Culminates in a project that connects the algorithms and hardware developed in the course with a selected topic in the current robotics research literature.

**CS 5340. Computer/Human Interaction. (4 Hours)**

Covers the principles of human-computer interaction and the design and evaluation of user interfaces. Topics include an overview of human information processing subsystems (perception, memory, attention, and problem solving); how the properties of these systems affect the design of user interfaces; the principles, guidelines, and specification languages for designing good user interfaces, with emphasis on tool kits and libraries of standard graphical user interface objects; and a variety of interface evaluation methodologies that can be used to measure the usability of software. Other topics may include World Wide Web design principles and tools, computer-supported cooperative work, multimodal and "next generation" interfaces, speech and natural language interfaces, and virtual reality interfaces. Course work includes both the creation and implementation of original user interface designs, and the evaluation of user interfaces created by others. Requires knowledge of C programming language/UNIX.

**CS 5350. Computational Geometry. (4 Hours)**

Surveys practical techniques for representing geometric objects in two and three dimensions, for computing their motions and interactions, and for human interfaces to manipulate them. These techniques are useful not only in graphics but also in robotics, computer vision, game design, geographic information systems, computer-aided design and manufacturing, spatial reasoning and planning, physical simulation, biomechanics, and the implementation of many types of human-computer interface. Requires undergraduate background in algorithms.

**Prerequisite(s):** CS 5800 with a minimum grade of C- or CS 7800 with a minimum grade of C-

**CS 5360. Noninteractive Computer Graphics. (4 Hours)**

Introduces computer graphics algorithms and concepts. Focuses on offline rendering techniques. Consists of a lecture component and in-class laboratory offering instruction about common image synthesis algorithms and techniques to generate images used in games and 3D-animated movies. Culminates in a final individual or group project to complete a renderer for generating high-quality images. This course is appropriate for students interested in a career as a graphics, rendering, or high-performance computer engineer.

**CS 5400. Principles of Programming Language. (4 Hours)**

Studies the basic components of programming languages, specification of syntax and semantics, and description and implementation of programming language features. Discusses examples from a variety of languages.

**Prerequisite(s):** CS 5010 with a minimum grade of D- or CS 5004 with a minimum grade of B- or CS 5010 with a minimum grade of C- (Graduate)

**CS 5500. Foundations of Software Engineering. (4 Hours)**

Covers the foundations of software engineering, including software development life cycle models (e.g., waterfall, spiral, agile); requirements analysis; user-centered design; software design principles and patterns; testing (functional testing, structural testing, testing strategies); code refactoring and debugging; software architecture and design; and integration and deployment. Includes a course project where some of the software engineering methods (from requirements analysis to testing) are applied in a team-based setting. Requires admission to MS program or completion of all transition courses.

**Prerequisite(s):** CS 5010 with a minimum grade of D or CS 5004 with a minimum grade of C or CS 5010 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**CS 5520. Mobile Application Development. (4 Hours)**

Focuses on mobile application development on a mobile phone or related platform. Discusses memory management; user interface building, including both MVC principles and specific tools; touch events; data handling, including core data, SQL, XML, and JSON; network techniques and URL loading; and, finally, specifics such as GPS and motion sensing that may be dependent on the particular mobile platform. Students are expected to work on a project that produces a professional-quality mobile application and to demonstrate the application that they have developed. The instructor chooses a modern mobile platform to be used in the course.

**CS 5540. Game Programming. (4 Hours)**

Covers the skills needed to develop easily scalable and modifiable scripts that can be used to implement various game mechanics common to most game genres. Programming is an integral part of the digital game design and development life cycle. Designed as a foundational game programming course covering numerous aspects of game programming. At least one semester of programming experience in a high-level language is required.

**CS 5600. Computer Systems. (4 Hours)**

Studies the structure, components, design, implementation, and internal operation of computer systems, focusing mainly on the operating system level. Reviews computer hardware and architecture including the arithmetic and logic unit, and the control unit. Covers current operating system components and construction techniques including the memory and memory controller, I/O device management, device drivers, memory management, file system structures, and the user interface. Introduces distributed operating systems. Discusses issues arising from concurrency and distribution, such as scheduling of concurrent processes, interprocess communication and synchronization, resource sharing and allocation, and deadlock management and resolution. Includes examples from real operating systems. Exposes students to the system concepts through programming exercises. Requires admission to MS program or completion of all transition courses.

**CS 5610. Web Development. (4 Hours)**

Discusses Web development for sites that are dynamic, data driven, and interactive. Focuses on the software development issues of integrating multiple languages, assorted data technologies, and Web interaction. Considers ASP.NET, C#, HTTP, HTML, CSS, XML, XSLT, JavaScript, AJAX, RSS/Atom, SQL, and Web services. Each student must deploy individually designed Web experiments that illustrate the Web technologies and at least one major integrative Web site project. Students may work in teams with the permission of the instructor. Each student or team must also create extensive documentation of their goals, plans, design decisions, accomplishments, and user guidelines. All source files must be open and be automatically served by a sources server.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CS 5700. Fundamentals of Computer Networking. (4 Hours)**

Studies network protocols, focusing on modeling and analysis, and architectures. Introduces modeling concepts, emphasizing queuing theory, including Little's theorem, M/M/1, M/M/m, M/D/1, and M/G/1 queuing systems. Discusses performance evaluation of computer networks including performance metrics, evaluation tools and methodology, simulation techniques, and limitations. Presents the different harmonizing functions needed for communication and efficient operation of computer networks and discusses examples of Ethernet, FDDI, and wireless networks. Covers link layer protocols including HDLC, PPP, and SLIP; packet framing; spanning tree and learning bridges, error detection techniques, and automatic repeat request algorithms; sliding window and reliable/ordered services; and queuing disciplines including FQ and WFQ. Introduces flow control schemes, such as window flow control and leaky bucket rate control schemes, and discusses congestion control and fairness. Requires knowledge of probability theory.

**CS 5800. Algorithms. (4 Hours)**

Presents the mathematical techniques used for the design and analysis of computer algorithms. Focuses on algorithmic design paradigms and techniques for analyzing the correctness, time, and space complexity of algorithms. Topics may include asymptotic notation, recurrences, loop invariants, Hoare triples, sorting and searching, advanced data structures, lower bounds, hashing, greedy algorithms, dynamic programming, graph algorithms, and NP-completeness.

**Attribute(s):** NUpath Formal/Quant Reasoning

**CS 5850. Building Game Engines. (4 Hours)**

Discusses the components of game engines and strategies for their software implementation. Includes graphics management algorithms (animation, scene graph, level of detail); basic artificial intelligence algorithms (search, decision making, sensing); and related algorithmic issues (networking, threading, input processing). Explores the use of data-driven software design. Offers students an opportunity to use a rendering engine and to build and integrate several software components to create a complete game engine. Requires students to work on individual assignments and then develop a project in a team, which requires a report. Offers students an opportunity to learn team/project management; work division; team communication; and the software development cycle of implementation, testing, critique, and further iteration. Requires knowledge of computer graphics, differential calculus, operating systems concepts, and algorithms.

**CS 5933. Advanced Computer Science Topics for Teachers. (4 Hours)**

Offers learners intending to be certified as K–12 computer science educators an advanced programming course. Covers GUI development and event-driven programming, an introduction to modeling and simulation, basics of computer networking and security, as well as topics related to the state of the art in computer science.

**CS 5934. Introduction to Inclusive Computer Science Teaching. (4 Hours)**

Introduces teaching computer science (CS) in grades K–12. Focuses on integrating CS concepts with other topic areas. Includes working with multilingual learners—examining student identities with respect to CS and exploring strategies for creating an inclusive CS classroom. Offers students an opportunity to design and practice implementing lesson plans for CS curricula at all grade levels, to explore current research in CS education, and to build a portfolio of teaching resources.

**CS 5963. Topics. (1,2 Hours)**

Offers students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering.

**CS 5964. Projects for Professionals. (0 Hours)**

Offers students an applied project setting in which to apply their curricular learning. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review 'lessons learned,' and incorporate suggestions from this review to improve and further develop their career development and professional plan. May be repeated twice.

**CS 5965. Engaging with Industry Partners for Rising Professionals. (0 Hours)**

Offers students an enhanced applied project setting in which to apply their curricular learning. Working with a partner sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with the partner sponsor, and create a plan for implementing their recommendations. Curriculum supports students as they develop key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review lessons learned, and incorporate suggestions to improve and further hone their career development and professional plan. Career development opportunities through skill-building workshops, panels, and interview preparation are available. Partner-student interactions, including a culminating project presentation, allow partners to assess student potential for co-op, internship, or other employment opportunities with the partner. May be repeated two times.

**CS 5976. Directed Study. (2-4 Hours)**

Focuses on student examining standard computer science material in fresh ways or new computer science material that is not covered in formal courses. May be repeated up to three times.

**CS 6120. Natural Language Processing. (4 Hours)**

Provides an introduction to the computational modeling of human language, the ongoing effort to create computer programs that can communicate with people in natural language, and current applications of the natural language field, such as automated document classification, intelligent query processing, and information extraction. Topics include computational models of grammar and automatic parsing, statistical language models and the analysis of large text corpuses, natural language semantics and programs that understand language, models of discourse structure, and language use by intelligent agents. Course work includes formal and mathematical analysis of language models, and implementation of working programs that analyze and interpret natural language text.

**CS 6130. Affective Computing. (4 Hours)**

Studies affective computing—computing that relates to, arises from, or influences emotions. Offers an overview of the theory of human emotion (how it arises from and influences cognition, the body, and the social environment) and computational techniques for modeling human emotion processes as well as for recognizing and synthesizing emotional behavior. Discusses how these can be applied to application design. Offers students an opportunity to gain a strong background in the theory and practice of human-centered computing as it relates to games, immersive environments, and pedagogical applications. Brings together students from different disciplines to work together and learn from each other. CS 6130 and PSYC 6130 are cross-listed.

**CS 6140. Machine Learning. (4 Hours)**

Provides a broad look at a variety of techniques used in machine learning and data mining, and also examines issues associated with their use. Topics include algorithms for supervised learning including decision tree induction, artificial neural networks, instance-based learning, probabilistic methods, and support vector machines; unsupervised learning; and reinforcement learning. Also covers computational learning theory and other methods for analyzing and measuring the performance of learning algorithms. Course work includes a programming term project.

**Prerequisite(s):** CS 5800 with a minimum grade of C- or CS 7800 with a minimum grade of C-

**CS 6170. AI Capstone. (4 Hours)**

Offers students a culminating experience through one or more projects to apply key concepts learned throughout their program in the core and elective courses. Emphasizes exploiting domain knowledge to facilitate interaction between humans and systems; developing intelligent interaction technologies; and critically assessing their social and ethical impacts.

**Prerequisite(s):** CS 5100 with a minimum grade of C- ; CS 5130 with a minimum grade of C- ; CS 5800 with a minimum grade of C- ; (CS 6140 with a minimum grade of C- or EECE 5644 with a minimum grade of C- )

**CS 6180. Foundations for Generative AI. (4 Hours)**

Offers students an opportunity to obtain both the theoretical foundation and practical skills to understand, analyze, and apply generative AI techniques effectively. Begins with foundational concepts in AI and machine learning; progresses to advanced natural language processing, transformer models, and large language models; and concludes with cutting-edge techniques like prompt engineering, domain-specific adaptations, and retrieval-augmented generation.

**Prerequisite(s):** CS 5100 with a minimum grade of C- or CS 5180 with a minimum grade of C- or CS 6120 with a minimum grade of C- or CS 6140 with a minimum grade of C- or CS 7140 with a minimum grade of C- or CS 7150 with a minimum grade of C-

**CS 6200. Information Retrieval. (4 Hours)**

Provides an introduction to information retrieval systems and different approaches to information retrieval. Topics covered include evaluation of information retrieval systems; retrieval, language, and indexing models; file organization; compression; relevance feedback; clustering; distributed retrieval and metasearch; probabilistic approaches to information retrieval; Web retrieval; filtering, collaborative filtering, and recommendation systems; cross-language IR; multimedia IR; and machine learning for information retrieval.

**CS 6220. Data Mining Techniques. (4 Hours)**

Covers various aspects of data mining, including classification, prediction, ensemble methods, association rules, sequence mining, and cluster analysis. The class project involves hands-on practice of mining useful knowledge from a large data set.

**Prerequisite(s):** CS 5800 with a minimum grade of C- or CS 7800 with a minimum grade of C-

**CS 6240. Large-Scale Parallel Data Processing. (4 Hours)**

Covers big-data analysis techniques that scale out with increasing number of compute nodes, e.g., for cloud computing. Emphasizes approaches for problem and data partitioning that distribute work effectively, while keeping total cost for computation and data transfer low. Studies and analyzes deterministic and random algorithms from a variety of domains, including graphs, data mining, linear algebra, and information retrieval in terms of their cost, scalability, and robustness against skew. Course work emphasizes hands-on programming experience with modern state-of-the-art big-data processing technology. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** CS 5800 with a minimum grade of C- or CS 7800 with a minimum grade of C- or EECE 7205 with a minimum grade of C-

**CS 6350. Empirical Research Methods. (4 Hours)**

Presents an overview of methods for conducting empirical research within computer science. These methods help provide objective answers to questions about the usability, effectiveness, and acceptability of systems. The course covers the basics of the scientific method, building from a survey of objective measures to the fundamentals of hypothesis testing using relatively simple research designs, and on to more advanced research designs and statistical methods. The course also includes a significant amount of fieldwork, spanning the design, conduct, and presentation of small empirical studies.

**CS 6410. Compilers. (4 Hours)**

Expects each student to write a small compiler. Topics include parser generation, abstract syntax trees, symbol tables, type checking, generation of intermediate code, simple code improvement, register allocation, run-time structures, and code generation.

**Prerequisite(s):** CS 5400 with a minimum grade of C- or CS 7400 with a minimum grade of C-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CS 6510. Advanced Software Development. (4 Hours)**

Designed to integrate academic concepts and practical experience of software design by having students work as part of a programming team, with an option to lead a subteam. Offers students an opportunity to study, in-depth, some aspects of the development process. The goal is to have students participate in a large-scale project, taking time to reflect and analyze the work and the process, rather than concentrating exclusively on the final product. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** (CS 5004 with a minimum grade of B- or CS 5010 with a minimum grade of C-); CS 5500 with a minimum grade of C-

**CS 6620. Fundamentals of Cloud Computing. (4 Hours)**

Covers fundamentals of cloud computing, including virtualization and containers, distributed file systems and object stores, infrastructure as a service platforms, open source cloud platforms, key big data platforms, and topics in data center scale systems. Combines classroom material delivered via lectures, readings from literature, student presentations, and a semester-long software project.

**CS 6640. Operating Systems Implementation. (4 Hours)**

Introduces concepts of OS kernels. Discusses the design and implementation of today's OS kernel components, such as process abstraction, virtual memory module, and file systems. Offers students an opportunity to obtain hands-on experience in building these components step-by-step through a series of assignments on a state-of-the-art hardware platform and to implement their own OS kernels that can run on bare-metal machines.

**Prerequisite(s):** CS 3650 with a minimum grade of D- or CS 5600 with a minimum grade of C-

**CS 6650. Building Scalable Distributed Systems. (4 Hours)**

Covers the essential elements of distributed, concurrent systems and builds upon that knowledge with engineering principles and practical experience with state-of-the-art technologies and methods for building scalable systems. Scalability is an essential quality of internet-facing systems and requires specialized skills and knowledge to build systems that scale at low cost.

**CS 6760. Privacy, Security, and Usability. (4 Hours)**

Challenges conventional wisdom and encourages students to discover ways that security, privacy, and usability can be made synergistic in system design. Usability and security are widely seen as two antagonistic design goals for complex computer systems. Topics include computer forensics, network forensics, user interface design, backups, logging, economic factors affecting adoption of security technology, trust management, and related public policy. Uses case studies such as PGP, S/MIME, and SSL. Introduces basic cryptography and hash function as it is needed. Course work includes analysis of papers, problem sets, and a substantial term project.

**CS 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**CS 6955. Co-op Work Experience Abroad - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated once.

**CS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CS 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**CS 6965. Co-op Work Experience Abroad. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated without limit.

**CS 6966. Practicum. (2-4 Hours)**

Provides eligible students with an opportunity for practical experience.

**CS 6983. Topics in Computer Science. (4 Hours)**

Offers various topics in computer science. May be repeated once.

**CS 7140. Advanced Machine Learning. (4 Hours)**

Covers topics in advanced machine learning. Presents materials in the current machine learning literature. Focuses on graphical models, latent variable models, Bayesian inference, and nonparametric Bayesian methods. Seeks to prepare students to do research in machine learning. Requires students to read conference and journal articles, present these articles, and write an individual research paper. CS 7140 and EECE 7397 are cross-listed.

**Prerequisite(s):** CS 6140 with a minimum grade of C- or EECE 7204 with a minimum grade of C- or EECE 7313 with a minimum grade of C-

**CS 7150. Deep Learning. (4 Hours)**

Introduces deep learning, including the statistical learning framework, empirical risk minimization, loss function selection, fully connected layers, convolutional layers, pooling layers, batch normalization, multilayer perceptrons, convolutional neural networks, autoencoders, U-nets, residual networks, gradient descent, stochastic gradient descent, backpropagation, autograd, visualization of neural network features, robustness and adversarial examples, interpretability, continual learning, and applications in computer vision and natural language processing. Assumes students already have a basic knowledge of machine learning, optimization, linear algebra, and statistics.

**Prerequisite(s):** CS 6140 with a minimum grade of C- or DS 5220 with a minimum grade of C-

**CS 7170. Seminar in Artificial Intelligence. (2-4 Hours)**

Offers students an opportunity to read and present various survey and research papers in artificial intelligence. May be repeated up to five times for a maximum of 24 semester hours. Faculty supervisor and topics vary from semester to semester.

**Prerequisite(s):** CS 5100 with a minimum grade of C- or CS 5100 with a minimum grade of D-

**CS 7180. Special Topics in Artificial Intelligence. (4 Hours)**

Offers various topics on artificial intelligence. May be repeated up to two times.

**CS 7200. Statistical Methods for Computer Science. (4 Hours)**

Introduces concepts in applied statistics. Covers frequentist and Bayesian characterization of uncertainty for continuous and categorical data, principles of experimental design, and methods of causal inference. Discusses the methodological foundations, as well as issues of practical implementation and use.

**CS 7240. Principles of Scalable Data Management: Theory, Algorithms, and Database Systems. (4 Hours)**

Covers the algorithms, core principles, and foundational concepts for managing data at scale. Topics include data models, query languages, query execution and optimization, complexity of query execution and query resilience, data stream processing, parallel data processing, transactions, linear vs. relational algebra, factorizations, and uncertainty in logic. Requires standard CS knowledge of algorithms and hardness (e.g., a typical undergraduate class based on a standard algorithms textbook such as Ericson; Cormen, Leiserson, Rivest, and Stein; or Dasgupta, Papadimitriou, and Vazirani). Offers students an opportunity to gain hands-on experience through smaller assignments and a project. The project is flexible to allow students to explore scalable data management and analysis aspects related to their PhD research.

**CS 7250. Information Visualization: Theory and Applications. (4 Hours)**

Covers foundational as well as contemporary topics of interest in data visualization to enable the effective representation of data across disciplines, including examples drawn from computer science, physical sciences, biomedical sciences, humanities, and economics. Topics include data visualization theory and methodology, visualization design and evaluation, visual perception and cognition, interaction principles, and data encoding and representation techniques. Students who do not meet course restrictions may seek permission of instructor.

**CS 7260. Visualization for Network Science. (4 Hours)**

Covers the principles of information visualization in the specific context of network science. Introduces visual encoding of data and our understanding of human vision and perception; interaction principles including filtering, pivoting, aggregation; and both quantitative and human subjects evaluation techniques. Covers visualization techniques for several network types, including multivariate networks with attributes for entities and relationships, evolving and dynamic networks that change over time, heterogeneous networks with multiple types of entities, and geospatial networks. Offers students an opportunity to learn about the design of layout algorithms for node-link and matrix visualizations.

**CS 7268. Verifiable Machine Learning. (4 Hours)**

Introduces verifiable machine learning, focusing on the limitations of current learning-based methods regarding safety and robustness. Explores adversarial robustness, uncertainty quantification, safety verification, reachability analysis, and safe/robust reinforcement learning. Examines neural network relaxations and their applications in robotics, control, image classification, medical diagnosis, and language modeling.

**CS 7270. Seminar in Database Systems. (2-4 Hours)**

Gives students the opportunity to read and present various survey and research papers in database systems. Faculty supervisor and topics vary from semester to semester. May be repeated once.

**Prerequisite(s):** CS 5200 with a minimum grade of C- or CS 5200 with a minimum grade of D-

**CS 7280. Special Topics in Database Management. (4 Hours)**

Offers various topics. Possible areas include object-oriented database systems and distributed database systems. May be repeated up to two times.

**CS 7290. Special Topics in Data Science. (4 Hours)**

Offers special topics in data science, including machine learning, statistics, data mining, parallel and distributed data analysis, database systems, information retrieval, knowledge representation, information visualization, natural language processing, computational biology and bioinformatics, computational social science, digital humanities, health informatics, business, and predictive analytics. May be repeated once for up to 8 total credits.

**CS 7295. Special Topics in Data Visualization. (4 Hours)**

Offers various topics in data visualization. May be repeated once.

**CS 7300. Empirical Research Methods for Human Computer Interaction. (4 Hours)**

Introduces concepts related to human subject studies for human computer interaction and personal health informatics. Discusses the methodological foundations, as well as issues of practical implementation and use. Provides an overview of the most common experimental designs used in these fields, and how studies should be proposed, conducted, analyzed, and documented for publication. Covers qualitative methods, including interviewing and focus groups, along with approaches to inductive qualitative data analysis. Methods discussed in the course are useful in any area of science that involves the application of the scientific method to situations involving people interacting with computational artifacts or systems, including observation, hypothesis formation, measurement, and descriptive and inferential statistical analyses.

**CS 7332. Machine Learning with Graphs. (4 Hours)**

Covers a number of advanced topics in machine learning and data mining on graphs, including vertex classification, graph clustering, link prediction and analysis, graph distance functions, graph embedding and representation learning, deep learning for graphs, anomaly detection, graph summarization, network inference, adversarial learning on networks, and notions of fairness in social networks. Seeks to familiarize students with state-of-the-art descriptive and predictive algorithms on graphs. Requires a foundational understanding of calculus and linear algebra, probability, machine learning or data mining, algorithms, and programming skills.

**Prerequisite(s):** PHYS 5116 with a minimum grade of C

**CS 7340. Theory and Methods in Human Computer Interaction. (4 Hours)**

Covers the foundations of human abilities, computational artifacts, design, and evaluation. Human computer interaction concerns the design and evaluation of software based on a deep understanding of how humans interact with computers, devices, and sensors. The field merges theories from psychology and computer science, using methods from AI and design. Introduces cognitive, perceptual, and affective theories and theories of individual differences that allow us to design and develop better computer software and systems. Also covers research methods for designing and evaluating computer software systems. Topics discussed in the context of next-generation interaction modalities include sensors, haptics, wearables, and performative interfaces. Students who do not meet course restrictions may seek permission of instructor.

**CS 7375. Seminar in Human-Computer Interaction. (4 Hours)**

Offers students an opportunity to read and present various survey and research papers in human-computer interaction, computer-supported collaborative work, data visualization, social computing, design, critical computing, accessibility, game design, health informatics, personal health informatics, human-robot interaction, or HCI in security. May be repeated once.

**CS 7380. Special Topics in Graphics/Image Processing. (4 Hours)**

Offers various topics on graphics/image processing. May be repeated up to two times.

**CS 7390. Special Topics in Human-Centered Computing. (4 Hours)**

Offers various topics in human-centered computing. May be repeated once.

**CS 7400. Intensive Principles of Programming Languages. (4 Hours)**

Studies the basic components of programming languages, specification of syntax and semantics, and description and implementation of programming language features. Discusses examples from a variety of languages.

**CS 7430. Formal Specification, Verification, and Synthesis. (4 Hours)**

Covers software and system modeling (how to formally describe the behavior of software and systems); specification (how to formally state the properties that the system should have); verification (how to check whether—and ultimately prove—that a system satisfies its specification); and synthesis (how to automatically generate software and systems that are "correct-by-construction").

**CS 7470. Seminar in Programming Languages. (2-4 Hours)**

Gives students the opportunity to read and present various survey and research papers in programming languages. Faculty supervisor and topics vary from semester to semester. May be repeated three times for a maximum of 16 total semester hours.

**Prerequisite(s):** CS 5400 with a minimum grade of C- or CS 5400 with a minimum grade of D- or CS 7400 with a minimum grade of C-

**CS 7480. Special Topics in Programming Language. (4 Hours)**

Offers various topics in programming language. May be repeated up to two times.

**CS 7485. Special Topics in Formal Methods. (4 Hours)**

Offers various topics in formal methods. May be repeated without limit.

**CS 7575. Seminar in Software Engineering. (2-4 Hours)**

Gives students the opportunity to read and present various survey and research papers in software engineering. Faculty supervisor and topics vary from semester to semester. May be repeated for credit for PhD students.

**Prerequisite(s):** CS 6520 with a minimum grade of C-

**CS 7580. Special Topics in Software Engineering. (4 Hours)**

Offers various topics on software engineering. May be repeated up to two times.

**CS 7600. Intensive Computer Systems. (4 Hours)**

Studies the structure, components, design, implementation, and internal operation of computer systems, focusing on the operating system level. Reviews computer hardware and architecture including the arithmetic and logic unit, and the control unit. Covers current operating system components and construction techniques including the memory and memory controller, I/O device management, device drivers, memory management, file system structures, and the user interface. Discusses distributed operating systems, real-time systems, and addresses concurrent processes, scheduling, interprocess communication, and synchronization. Discusses relevant distributed algorithms. Also covers design and analysis techniques for desirable properties in computer systems including functional correctness (in the absence of faults), performance and throughput, fault-tolerance and reliability, real-time response, security, and quality of service. Draws examples from real operating systems. Emphasizes abstraction, while programming exercises are used to facilitate the understanding of concepts.

**CS 7610. Foundations of Distributed Systems. (4 Hours)**

Covers foundational concepts in the design and implementation of efficient and reliable distributed computing systems. Covers internet communication protocols, fault-tolerant computing, synchronization protocols, synchronous and asynchronous computing, dynamic group communication systems, load balancing, Byzantine models, distributed hash tables, distributed file systems, and application of foundational concepts to modern distributed systems in the field. Requires knowledge of operating systems; e.g., an undergraduate course in Systems and Networks, Computer Systems, or Networks and Distributed systems.

**CS 7670. Seminar in Computer Systems. (2-4 Hours)**

Gives students the opportunity to read and present various survey and research papers in computer systems. Faculty supervisor and topics vary from semester to semester. May be repeated three times for a maximum of 16 total semester hours.

**Prerequisite(s):** CS 5600 with a minimum grade of C- or CS 5600 with a minimum grade of D- or CS 7600 with a minimum grade of C-

**CS 7675. Master's Research. (4 Hours)**

Exposes students to research in the fields of computer sciences. Explores how the scientific method is applied to these fields and covers the breadth of subareas of specialty that exist. Offers students an opportunity to practice how to locate and read scientific literature in different subareas. May be repeated once.

**CS 7680. Special Topics in Computer Systems. (4 Hours)**

Offers various topics on computer systems. May be repeated up to two times.

**CS 7770. Seminar in Computer Networks. (2-4 Hours)**

Gives students the opportunity to read and present various survey and research papers in computer networks. Faculty supervisor and topics vary from semester to semester. May be repeated for credit for PhD students.

**Prerequisite(s):** CS 5700 with a minimum grade of C- or CS 5700 with a minimum grade of D-

**CS 7775. Seminar in Computer Security. (2-4 Hours)**

Gives students the opportunity to read and present various survey and research papers in cryptography and computer security. Faculty supervisor and topics vary from semester to semester. May be repeated for credit for PhD students.

**CS 7800. Advanced Algorithms. (4 Hours)**

Presents advanced mathematical techniques for designing and analyzing computer algorithms. Reviews some of the material covered in CS 5800 and then covers advanced topics. Emphasizes theoretical underpinnings of techniques used to solve problems arising in diverse domains. Topics include asymptotic analysis, advanced data structures, dynamic programming, greedy algorithms and matroid theory, amortized analysis, randomization, string matching, algebraic algorithms, and approximation algorithms. Introduces Turing machines, P and NP classes, polynomial-time reducibility, and NP completeness.

**CS 7805. Complexity Theory. (4 Hours)**

Covers core topics in computational complexity, including NP-completeness, time and space complexity, polynomial hierarchy, circuit complexity, probabilistic computation, interactive proofs, and hardness of approximation. Moves to more advanced topics that may include lower bounds, pseudorandomness, cryptography, and communication complexity.

**Prerequisite(s):** CS 7800 with a minimum grade of C-

**CS 7810. Foundations of Cryptography. (4 Hours)**

Offers students at the PhD level an accelerated introduction to cryptography and quickly progresses to advanced topics that are at the forefront of current research. Cryptography is the science of protecting information against adversarial eavesdropping and tampering. Examines what kind of security properties can be achieved by relying solely on probability and information theory, without restricting the adversary's computational power. Studies the complexity-theoretic basis of modern cryptography and the connection between computational hardness and pseudo-randomness. Explores, as the main component of the course, how to take a few well-studied problems in number theory and algebra and use them to build powerful cryptosystems with advanced functionality and security properties. Requires prior completion of an undergraduate course in the theory of computation.

**CS 7840. Foundations and Applications of Information Theory. (4 Hours)**

Studies information theory and selected applications for data management, machine learning, and information retrieval. Information theory examines the transmission, processing, extraction, and utilization of information. Topics include entropy; mutual information; cross-entropy; data processing theorem; information inequalities; Cox's theorem; maximum entropy solutions; and applications such as data normalization, decision trees, maximum likelihood, logistic regression, and VC dimensions. Requires prior study of standard computer science algorithms. Offers hands-on experience through a flexible project, allowing students to explore information theory in aspects related to their PhD research.

**CS 7870. Seminar in Theoretical Computer Science. (2-4 Hours)**

Gives students the opportunity to read and present various survey and research papers in theoretical computer science. Faculty supervisor and topics vary from semester to semester. May be repeated three times for a maximum of 16 total semester hours.

**Prerequisite(s):** CS 5800 with a minimum grade of C- or CS 5800 with a minimum grade of D- or CS 7800 with a minimum grade of C-

**CS 7880. Special Topics in Theoretical Computer Science. (4 Hours)**

Covers various topics including advanced cryptography, approximation algorithms, complexity theory, computational algebra, distributed computing, formal verification, network algorithms, online computation, parallel computing, and randomness and computation. May be repeated up to two times.

**CS 7930. Effective Scientific Writing in Computer Science. (2 Hours)**

Introduces the principles and practice of technical communication in computer science and related fields. Emphasizes concepts such as genre, structure, argument, and audience expectations. Focuses on the story of scientific research and how it manifests in written genre like the abstract, research statement, and conference paper, with a portion of the course focused on presentation design and delivery.

**CS 7962. Elective. (2-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CS 7976. Directed Study. (2-4 Hours)**

Focuses on student examining standard computer science material in fresh ways or new computer science material that is not covered in formal courses. May be repeated without limit.

**CS 7980. Research Capstone. (4 Hours)**

Offers students a culminating experience to demonstrate proficiency in key concepts learned throughout their programs in the core and elective courses. Designed to reinforce concepts in ethics and basic concepts in research, beyond an emphasis on the technical principles learned throughout the program.

**Prerequisite(s):** (CS 5004 with a minimum grade of C- or CS 5010 with a minimum grade of C-); CS 5800 with a minimum grade of C-

**CS 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**CS 7990. Thesis. (4 Hours)**

Offers selected work with the agreement of a project supervisor. May be repeated once.

**CS 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers continued thesis work conducted under the supervision of a departmental faculty.

**Prerequisite(s):** CS 7990 with a minimum grade of C-

**CS 8674. Master's Project. (4 Hours)**

Offers selected work with the agreement of a project supervisor. May be repeated once.

**CS 8948. Research Work Experience - Half-Time. (0 Hours)**

Provides an opportunity for all doctoral students to engage in industry research in the area of their dissertation. Doctoral students register for this course before starting their off-campus internship. May be repeated up to five times.

**CS 8949. Research Work Experience. (0 Hours)**

Provides an opportunity for all doctoral students to engage in industry research in the area of their dissertation. Doctoral students register for this course before starting their off-campus internships. May be repeated without limit.

**CS 8982. Readings. (1-8 Hours)**

Offers selected readings under the supervision of a faculty member. May be repeated without limit.

**CS 8986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**CS 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**CS 9990. Dissertation Term 1. (0 Hours)**

Offers selected work with the agreement of a thesis supervisor.

**Prerequisite(s):** CS 9000 with a minimum grade of S

**CS 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** CS 9990 with a minimum grade of S

**CS 9996. Dissertation Continuation. (0 Hours)**

Continues work with the agreement of a thesis supervisor.

**Prerequisite(s):** CS 9991 with a minimum grade of S or Dissertation Check with a score of REQ

**Computer Systems Engineering (CSYE)****CSYE 5280. Introduction to User Experience Design and Testing. (4 Hours)**

Introduces core principles of user experience and interaction design in the context of web and mobile application development. Emphasizes human-centered design strategies including user research, persona development, wireframing, and prototyping. Covers tools and techniques for creating mid- and high-fidelity prototypes, along with approaches to usability testing, quality assurance, and validation. Highlights methods for translating user requirements into intuitive and accessible digital experiences, with a focus on aligning design decisions to customer needs and business goals.

**CSYE 5374. Special Topics in Software Engineering Systems. (1-4 Hours)**

Offers topics of current interest in software engineering systems. May be repeated up to three times for a maximum of 16 semester hours.

**CSYE 5976. Directed Study. (1-4 Hours)**

Offers theoretical or experimental work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated up to seven times for a maximum of 8 semester hours.

**CSYE 6200. Concepts of Object-Oriented Design. (4 Hours)**

Introduces object-oriented design and programming via the Java programming language; the use of inheritance, composition, and interface classes in software design; development of Java applets and applications; study of the Java class libraries, including the swing tool kit for building human computer interfaces, the network package for development of client-server systems, and the collections' package for data structures and sorting algorithms. Requires a course project. Requires knowledge of C programming.

**CSYE 6202. Concepts of Object-Oriented Design with C#. (4 Hours)**

Introduces object-oriented design and programming via the C# (C-sharp) programming language and its underlying .NET platform. Covers the use of inheritance and composition in software design and development of complex C# .NET applications. Topics include classes, overloading, data abstraction, information hiding, encapsulation, inheritance, polymorphism, file processing, templates, exceptions, container classes, and low-level language features.

**CSYE 6205. Concepts of Object-Oriented Design with C++. (4 Hours)**

Introduces object-oriented design and programming via the C++ programming language. Covers the use of inheritance and composition in software design and development of complex C++ applications. Topics include classes, overloading, data abstraction, information hiding, encapsulation, inheritance, polymorphism, file processing, templates, exceptions, container classes, and low-level language features. Requires a course project.

**CSYE 6220. Enterprise Software Design. (4 Hours)**

Designed to build on previous experience in concepts of object-oriented design courses with equal focus in the three areas of architecture, design, and implementation. Instruction and hands-on exercises cover both server-side and client-side web programming. Offers students an opportunity to build a conceptual understanding and to gain practical experience with popular frameworks (Spring MVC, Hibernate, and Dojo or jQuery) that increase productivity, empower developers, and greatly simplify web development. The goal is to be able to build the server side and client side of substantial web-based, client-server, database-intensive, multitier applications.

**Prerequisite(s):** CSYE 6200 with a minimum grade of B- or CSYE 6202 with a minimum grade of B- or CSYE 6205 with a minimum grade of B-

**CSYE 6225. Network Structures and Cloud Computing. (4 Hours)**

Offers a practical foundation in cloud computing and hands-on experience with the tools used in cloud computing. Designed as a foundation course for cloud-aware, adept professionals. Focuses on the fundamentals of cloud computing, the principal areas of cloud architectures, cloud security, cloud governance, cloud storage, cloud virtualization, and cloud capacity. Discusses the Internet evolution that led to cloud and how cloud applications revolutionized Web applications.

**Prerequisite(s):** CSYE 6200 with a minimum grade of B- or INFO 5100 with a minimum grade of B- or INFO 5100 with a minimum grade of B-

**CSYE 6230. Operating Systems. (4 Hours)**

Covers basic concepts of operating systems and system programming, such as utility programs, subsystems, and multiple-program systems. Main topics include processes, interprocess communication, and synchronization; memory allocation, segmentation, and paging; loading, linking, and libraries; resource allocation, scheduling, and performance evaluation; file systems, storage devices, and I/O systems; and protection, security, and privacy. Emphasizes key concepts through code design and development.

**Prerequisite(s):** INFO 6205 with a minimum grade of B-

**CSYE 6255. Software Testing for Engineers. (4 Hours)**

Covers the principles and processes of validation, verification, and integration for software and software-intensive systems, including cyberphysical systems. Topics include test automation, testing metrics, test coverage, integration testing, state space exploration for cyberphysical systems, software assurance, and software reliability. Explores the principles, tools, applications, and processes that efficiently integrate software elements to meet customer requirements and needs.

**Prerequisite(s):** CSYE 6200 with a minimum grade of B- or INFO 5100 with a minimum grade of B-

**CSYE 6300. Software Design Patterns and Engineering. (4 Hours)**

Covers design patterns including Factory, Command, and Decorator. Design patterns allow software engineers to use abstraction to design software that is extensible, maintainable, and cost-effective. Each design pattern is implemented using industry best practices and shown to solve real-world problems. Uses a pragmatic teach-by-example/learn-by-doing methodology; lecture examples can be applied to any object-oriented language. Offers students an opportunity to master concepts and develop skills in a demystifying and easy-to-absorb format.

**Prerequisite(s):** CSYE 6200 with a minimum grade of B- or INFO 5100 with a minimum grade of B-

**CSYE 6305. Introduction to Quantum Computing with Applications. (4 Hours)**

Addresses how scientists and engineers can use quantum computers to simulate large quantum mechanical systems easily, which is crucial in discovery of new lifesaving drugs and new efficient materials. Quantum computers maintain an abstract state where both 0 and 1 states exist simultaneously with some probability. The course delves deeper into how such an abstract state can be realized physically and used as a computing tool to simplify algorithm implementation and execution. Offers students an opportunity to learn about the latest breakthroughs in cryptography systems (RSA), as well as fast database search; accurate weather forecasting; ultrasecure communication; and fast image recognition.

**Prerequisite(s):** CSYE 6200 with a minimum grade of B- or DAMG 6105 with a minimum grade of B- or INFO 5100 with a minimum grade of B-

**CSYE 6374. Special Topics in Software Engineering Systems. (1-4 Hours)**

Offers topics of current interest in software engineering systems. May be repeated up to three times for a maximum of 16 semester hours.

**CSYE 6700. Technical Writing and Professional Development. (0 Hours)**

Emphasizes professional communication skills through intensive verbal practice and technical writing application. Students work together in groups and individually to practice verbal and written communication to increase their English competency and comfort level for work in the United States. Offers students an opportunity to develop their ability to communicate technical skills sets in a professional setting. This course does not count toward graduation requirements.

**CSYE 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CSYE 7105. High-Performance Parallel Machine Learning and AI. (4 Hours)**

Explores the parallelization of machine learning and deep learning code that leads to high performance on heterogeneous cluster architectures. Includes the applications to a variety of domains, including image classification, speech recognition, and natural language processing, etc. Covers a brief overview of the emerging parallel computing applications. Analyzes system architectures for different kinds of parallel computing systems (shared-memory system, distributed-memory system, accelerator system, and hybrid). Offers students an opportunity to practice the principles and the practice of the emerging parallelism-based machine-learning paradigm.

**Prerequisite(s):** DAMG 6105 with a minimum grade of B or INFO 6105 with a minimum grade of B

**CSYE 7125. Advanced Cloud Computing. (4 Hours)**

Examines a collection of repeatable, generic software design patterns such as sidecar pattern, ambassador pattern, adapter pattern, event driven, stream and batch processing, containers and container orchestration with Kubernetes, replication, partitioning, transactions, consistency, and consensus to help make the development of reliable distributed systems more approachable and efficient. Microservices, containers, and container orchestration have fundamentally changed how distributed systems are developed. Offers students an opportunity to determine which kind of technology is appropriate for which purpose and to understand how these patterns can be combined to form the foundation of a good application architecture.

**Prerequisite(s):** CSYE 6225 with a minimum grade of B

**CSYE 7200. Big-Data System Engineering Using Scala. (4 Hours)**

Covers the fundamentals of functional programming with Scala and seeks to provide a basic, practical foundation for students who want to use it as a language for working with big-data platforms. Scala is one of a new breed of general-purpose functional programming languages that is strongly typed and is object oriented. It runs on the Java virtual machine and is able to share libraries from the vast collection of open-source projects written in Java. For these reasons it is readily accessible by programmers of Java, C++, and similar languages.

**CSYE 7215. Foundations of Parallel, Concurrent, and Multithreaded Programming. (4 Hours)**

Covers all aspects of concurrent program design, development, and implementation utilizing the Java multithreading API/facilities. Topics covered include thread safety and lifetime issues, block structured versus explicit synchronization, intrinsic versus explicit locking, thread pools, liveness issues, deadlock, livelock, race conditions, atomicity, performance and scalability, execution policies, test strategies. Major Java multithreading API/facilities covered include synchronized blocks, wait sets, intrinsic locks and condition variables, synchronized and concurrent collections, executor framework. Comparisons between the Java multithreading API and the Posix Pthreads multithreading standard are provided.

**Prerequisite(s):** CSYE 6200 with a minimum grade of B- or INFO 5100 with a minimum grade of B- or INFO 5100 with a minimum grade of B-

**CSYE 7220. Deployment and Operation of Software Applications. (4 Hours)**

Introduces the four most popular infrastructure languages—Chef, Puppet, Ansible, and Salt—and codes with them in the same way that we code with Java, Python, C#, and JavaScript. IT infrastructure languages and their underlying methods and tools, referred to as DevOps, bridge the gap between software development and software administration. Instead of recruiting CPU cycles on our laptops, we create and manage virtual IT infrastructures on a public cloud. Offers students an opportunity to learn how to manipulate virtual machines, containers, and lambdas and set up assembly lines on public clouds in the fashion of a Model T assembly line.

**Prerequisite(s):** CSYE 6220 with a minimum grade of B- or INFO 6250 with a minimum grade of B-

**CSYE 7230. Software Engineering. (4 Hours)**

Looks at the software life cycle (requirements analysis and specification, software design, coding, testing, and maintenance). Offers verification, validation, and documentation at various stages of the life cycle. Covers the Unified Modeling Language as applied to the software life cycle. Covers applications of design patterns. Overviews user interface design, software metrics, and software development environments. Emphasis is on modular software construction and development of modular libraries. Requires a small software development project.

**Prerequisite(s):** CSYE 6200 (may be taken concurrently) with a minimum grade of B- or INFO 5100 (may be taken concurrently) with a minimum grade of B- or INFO 5100 (may be taken concurrently) with a minimum grade of B-

**CSYE 7235. Model-Driven Architecture. (4 Hours)**

Develops the skills to utilize new software modeling and management techniques in each state of the life cycle of component-based software systems. Applies and extends a basic knowledge of the Unified Modeling Language (UML). Introduces and applies metamodel management concepts using the OMG metaobject facility as a technology baseline. Develops a component-based software project throughout the course using C++ or Java; grading primarily based on the software project and its public presentation.

**Prerequisite(s):** INFO 6205 with a minimum grade of B-

**CSYE 7270. Building Virtual Environments. (4 Hours)**

Covers the basics of three-dimensional graphics programming using the Unity game engine. Includes a built-in terrain editor; a shader development facility; built-in physics; and advanced lighting, shadows, and audio to build 3D virtual environments and serious games. Javascript and C# can be used for scripting. Assets from various 3D modeling programs can be imported. Facilities to publish to the PC, Mac, iPhone and Wii and support for real-time multiplayer games are available. Requires a final project.

**CSYE 7280. User Experience Design and Testing. (4 Hours)**

Introduces user experience concepts while working on Web design projects. Offers students an opportunity to build the necessary skill sets to make better decisions when designing contemporary websites that cater to customer needs. Students practice interview techniques to understand user requirements while keeping user experience central to the effort. Uses wireframes and user scenarios to drive the creative design process. Various case studies are introduced and discussed in team settings to emphasize user perspectives. Uses quality assurance and usability testing to drive validation and user-acceptance testing and approvals.

**Prerequisite(s):** CSYE 6200 (may be taken concurrently) with a minimum grade of B- or INFO 5100 (may be taken concurrently) with a minimum grade of B- or INFO 5100 (may be taken concurrently) with a minimum grade of B-

**CSYE 7300. Zero Trust Architecture for Software Engineers. (4 Hours)**

Explores how to integrate Zero Trust security measures in software systems from the ground up to address evolving cybersecurity threats effectively. Focuses on the impact of Zero Trust principles on software design and deployment. Through class lectures, practical workshops, and collaborative projects, offers students an opportunity to obtain the skills to design, develop, and maintain secure software applications in various environments, including cloud-based and decentralized infrastructures. Intended for software engineers.

**Prerequisite(s):** CSYE 6200 with a minimum grade of B- or INFO 5100 with a minimum grade of B-

**CSYE 7370. Deep Learning and Reinforcement Learning in Game Engineering. (4 Hours)**

Introduces a deep learning and reinforcement learning framework for games called ML-Agents, which enable games and simulations to serve as environments for training intelligent agents. Studies and reviews classical game artificial intelligence (game AI), primarily search and decision trees. Uses game AI to generate responsive, adaptive, or intelligent behaviors primarily in nonplayer characters (NPCs) similar to human-like intelligence. Game AI includes everything from simple chasing and evading to pattern movement, to create opponents with complex tactical and strategic decisions.

**Prerequisite(s):** INFO 5100 with a minimum grade of B or INFO 5100 with a minimum grade of B or CSYE 6200 with a minimum grade of B

**CSYE 7374. Special Topics in Computer Systems Engineering. (4 Hours)**

Offers topics of current interest in computer systems engineering. May be repeated without limit.

**CSYE 7380. Theory and Practical Applications of AI Generative Modeling. (4 Hours)**

Covers transformer-based language models (e.g., ChatGPT and Bard); generative image models (e.g., GAN and variational autoencoder); and generative models for structured data (e.g., Bayesian networks). Explores generative models for data of major modalities, namely, textual, image, and structured relational. Offers students an opportunity to learn how to build such models for practical applications in different verticals using Python and numerous publicly available libraries in Keras/TensorFlow and PyTorch. Given recent surges in generative modeling tools, generative modeling technologies and applications are necessary skills for students entering the field of industrial data science.

**Prerequisite(s):** CSYE 6200 with a minimum grade of B- or DAMG 6105 with a minimum grade of B- or INFO 5100 with a minimum grade of B-

**CSYE 7400. Responsible Software Engineering and AI. (4 Hours)**

Offers a deep dive into the ethical, societal, and governance challenges posed by rapidly advancing AI technologies. Designed for individuals seeking to develop AI ethics and the frameworks necessary to responsibly govern AI systems. Covers a wide range of emerging AI technologies including generative AI, autonomous systems, and augmented reality, while emphasizing the importance of responsible AI usage. Examines the skills needed to critically assess AI systems, develop ethical AI solutions, and contribute to the creation of governance frameworks that prioritize both innovation and societal well-being. Combines theoretical exploration and hands-on projects to address issues such as fairness, bias, accountability, privacy, and security in AI systems.

**CSYE 7470. Advanced Game Analytics. (4 Hours)**

Explores the use of deep learning for the automated creation and analysis of game metrics. Uses convolutional neural networks (CNNs) to segment and identify anything on a game screen in real-time, which is used as input to AI systems. The second part of the course analyzes the importance of the metrics. Covers surrogate models, Shannon entropy, Individual Conditional Expectation (ICE), leave-one-covariate-out (LOCO), local feature importance, partial dependency plots, tree-based feature importance, standardized coefficient importance, accumulated local effects (ALE) plots, and Shapley values. Lastly, covers building predictive models with game data using the following techniques: supervised learning, generative/discriminative learning, parametric/nonparametric learning, neural networks, unsupervised learning reinforcement learning, and adaptive control.

**Prerequisite(s):** INFO 6105 with a minimum grade of B

**CSYE 7550. Distributed Intelligent Agents in the Metaverse. (4 Hours)**

Introduces the field of agent-based computing as enablers of metaverse social avatar systems. Focuses on important aspects that shape the agent's experience within the challenging virtual-reality design and engineering landscape. Covers personal space, personified locomotion, agent aesthetics, agent social interactions, and agent's relation to blockchain decentralized virtual identity. Students engage in projects to deliver VR platforms applicable to engineering fields such as mechanical, civil, chemical, and bioengineering. Considers distributed learning applications and certification of credentials, as well. Offers students an opportunity to learn how to configure various agent types to construct virtual worlds bursting with lively agent interactive experiences that go far beyond the constraints of the physical reality.

**Prerequisite(s):** CSYE 7270 with a minimum grade of B ; INFO 6205 with a minimum grade of B

**CSYE 7945. Master's Project. (4 Hours)**

Supports teamwork on a large software project under faculty supervision. The projects are drawn from an engineering field, and involve design, systems engineering, manufacturing, planning maintenance, reliability, quality control, risk assessment, project control, evaluation of alternatives, and so on. The project may cover either the whole software development life cycle or a significant part of it.

**CSYE 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CSYE 7976. Directed Study. (1-4 Hours)**

Offers theoretical or experimental work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated up to seven times for a maximum of 8 semester hours.

**CSYE 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**CSYE 7990. Thesis. (4 Hours)**

Offers analytical and/or experimental work conducted under the direction of the faculty in fulfillment of the requirements for the degree.

**Prerequisite(s):** CSYE 7945 with a minimum grade of C-

**CSYE 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers analytical and/or experimental work conducted under the auspices of the department.

## Construction Management - CPS (CMG)

### **CMG 6400. Introduction to Construction Management. (4 Hours)**

Seeks to provide a foundation in both technical skills and individual written and verbal communication for construction project managers. Since students come to the program from a variety of educational and experience backgrounds, offers students an opportunity to be assessed and brought to the level necessary for successful completion of the program. Topics covered include construction documentation, including specifications and drawings; the preconstruction processes required for planning; and construction operations needed for successful operations and control, including estimating, cost control, and change-order management. Students practice scheduling techniques, progress monitoring, and reporting approaches for projects and are introduced to construction organizations, contractor selection, and project procurement.

### **CMG 6402. Alternative Project Delivery Methods and Project Controls. (4 Hours)**

Offers a comprehensive overview of alternative project delivery systems in public and private sectors. Topics include project life cycle; alternative project design, including building information modeling (BIM); schedule; cost and value management; project and program management; project closeout; and innovative procurement strategies. Also examines international projects, contracts, terminations, defaults, and sustainable and integrated project delivery (IPD) as vehicles to ensure the meeting of project objectives. Uses case studies and real-world examples to identify and practice the leadership skills required for successful project execution.

### **CMG 6403. Safety, Project Risk, and Quality Management. (4 Hours)**

Offers students an opportunity to learn how to develop and manage a risk identification, analysis, and response plan. Students look at project participants and several construction processes with a focus on the safety, risk, and quality impacts on those processes. Covers the latest techniques to ensure that a project provides a safe environment for everyone. Studies the analytical tools necessary to ensure customer satisfaction in the area of quality and examines both quality control and assurance processes.

### **CMG 6405. Construction Law. (4 Hours)**

Explores the statutory and legal context of contracts in construction. Covers business ethics and examines the legal issues that may result in bidding mistakes and construction disputes over such matters as differing expectations regarding specifications and plans, time and schedule impacts, delays and acceleration, change orders, and differing and unforeseen conditions. Explores some areas of warranties and guarantees; joint liability; and contract-dispute resolution, including negotiation, alternative dispute resolution, and litigation.

### **CMG 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Co-op/Experiential Education in Arts, Media, and Design (EEAM)

### **EEAM 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **EEAM 2000. Professional Development for Co-op. (1 Hour)**

Introduces students to the Cooperative Education Program and provides them with an opportunity to develop job-search and career-management skills. Offers students an opportunity to perform assessments of their workplace skills, interests, and values and discuss how they impact personal career choices. Students also have an opportunity to prepare a professional-style résumé, learn proper interviewing techniques, and gain an understanding of the opportunities available to them for co-op. Introduces career paths, choices, professional behaviors, work culture, and career decision making. Familiarizes students with workplace issues relative to their field of study and teaches them to use myNEU in the job-search and referral process. Presents co-op policies, procedures, and expectations of the Department of Cooperative Education and co-op employers.

### **EEAM 2010. Internship for Career Decision Making. (1 Hour)**

Offers students an opportunity to gain experience in a field they would like to explore and receive internship credit. Students complete a one-hundred-hour internship during the semester, which they obtain prior to the course. Students attend group meetings and individual appointments with the instructor, maintain a weekly journal, and complete an evaluation of their internship experience.

**EEAM 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EEAM 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EEAM 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EEAM 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**EEAM 6955. Co-op Work Experience Abroad - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**EEAM 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EEAM 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**EEAM 6965. Co-op Work Experience Abroad. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated without limit.

## Co-op/Experiential Education in Business (EEBA)

**EEBA 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EEBA 2945. Internship Experience. (0 Hours)**

Offers an opportunity for employment-based experiential learning and fosters the integration of knowledge and skills across contexts through course activities. May be repeated up to three times.

**Attribute(s):** NUpath Integration Experience

**EEBA 2948. Internship Experience Abroad. (0 Hours)**

Offers an opportunity for employment-based experiential learning and fosters the integration of knowledge and skills across contexts through course activities. May be repeated up to three times.

**Attribute(s):** NUpath Integration Experience

**EEBA 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EEBA 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EEBA 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EEBA 6401. Experiential Business Decision Making. (3 Hours)**

Offers guided instruction about problem identification, problem-solving skills, and working as a team to meet the needs of internal and external stakeholders. The instructor and selected industry experts work with student teams through lectures, question-and-answer sessions, and team feedback sessions to offer real-world feedback. Offers students an opportunity to leverage skills and thinking through an immersive experience; develop observations and reflections of complex situations or challenges; frame the challenges, drawing on concepts, observed patterns, and experiences; synthesize insights into a creative solution; and apply the learnings to new situations.

**EEBA 6402. EXPO Challenge: Sustainability. (2 Hours)**

Provides a project-based experiential learning opportunity for students to leverage insights on stakeholder values and societal challenges in business. Offers students an opportunity to explore and apply best practices in environmental sustainability to impact societal challenges associated with climate change. Students work in teams to bring their experience and newly learned skills to solve a real sustainability-related business problem. Includes guidance and feedback from industry experts and peers through interviews, case studies, question-and-answer sessions, and team feedback sessions.

**EEBA 6403. EXPO Challenge: Diversity, Equity, and Inclusion. (2 Hours)**

Provides a project-based experiential learning opportunity for students to leverage insights on stakeholder values and societal challenges in business. Offers students an opportunity to explore and apply best practices in promoting diverse, equitable, and inclusive workplaces. Students work in teams to bring their experience and newly learned skills to solve a real DEI-related business problem. Includes guidance and feedback from industry experts and peers through interviews, case studies, question-and-answer sessions, and team feedback sessions.

**EEBA 6404. Key Developments in Environmental, Social, and Governance Investing. (2 Hours)**

Offers students a hands-on opportunity to research and compare environmental, social, governance, and non-ESG portfolios while hearing from industry experts along the way. Exposes students to how and why investors engage in ESG investing and how to analyze the performance and risk of such investing. Covers what rating firms are, what global financial resources are committed to ESG investing, the regulatory landscape, and the ongoing challenges that ESG investing poses. Emphasizes the tenets of this type of investing from multiple perspectives, including portfolio managers, institutional investors, retail investors, trade groups, regulators, and political factions.

**EEBA 6405. Persuasive Sales, Personal and Professional. (1 Hour)**

Introduces selling and the industry of B2B professional selling. Focuses on sales skills that span any function. Covers selling roles and mastery of key selling and presenting skills. Emphasizes heightening persuasive selling skills needed personally and professionally to achieve success. Examines the use of negotiation to achieve the best possible outcomes. Engages in hands-on exercises and real-world simulations to hone sales skills across a range of different scenarios.

**EEBA 6406. Managing Operational Disruption in Healthcare. (1 Hour)**

Studies the current and ever-changing healthcare environment and potential disruptions to healthcare organizations. Covers skills needed for problem identification, problem solving, and operational execution within the organization. Offers students an opportunity to leverage skills and thinking through a highly experiential, immersive experience; develop observations and reflections of complex situations or challenges; frame the challenges, drawing on concepts, observed patterns, and experiences; synthesize insights into a creative solution; and apply the learnings to new situations.

**EEBA 6407. Brand Development and Advertising Application. (1 Hour)**

Explores the landscape of brand building amid ever-evolving marketing communication platforms. Utilizes inquiry-based research practices and experiential study culminating in a project to delve into the art of brand development and advertising. Offers students an opportunity to apply key concepts such as positioning, targeting, creativity, media mix, and integrated brand promotion strategies. Emphasizes responding to the challenges and opportunities presented by modern marketing trends.

**EEBA 6408. Innovation Behaviors. (2 Hours)**

Focuses on the behaviors that either enable or inhibit innovation. Emphasizes demystifying the ideation process and offering specific practices that have been shown to support creativity and innovation. Includes concepts that effective innovators use to bring good ideas to life, such as tactics of influence and persuasion, optimizing team innovation and learning, and leadership practices focused on innovation. Offers students an opportunity to develop a proposed innovation idea and implementation plan for a real-world problem. Includes evaluation by an industry expert.

**EEBA 6409. Strategy: Successful Internationalization. (2 Hours)**

Offers concepts, frameworks, and information useful for analyzing a company's international strategy and helping it create and capture value. Integrates and extends ideas presented in functional courses to provide a comprehensive overview of top managers' strategic decisions and is organized around key strategic decisions to enhance comprehension of strategy. Explains the logic for recommending one course of action over others and the conditions under which it is likely to be more successful. Engages students with a real client, providing them with valuable exposure to authentic strategic situations encountered in the real world.

**EEBA 6410. Workplace Skills in Action. (1 Hour)**

Offers a structured pathway to validate and enhance professional skills. Students will engage in reflective practice projects and real-world client engagements to document and demonstrate skills. Curated resources, including readings, videos, and supplementary materials, are designed to support skill development. Students will have the opportunity to participate written reflection assignments, that focus on applying specific subskills in the workplace, to promote self-awareness and skill enhancement. Regular progress updates and personalized coaching sessions support continuous personal and professional growth.

**EELA 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Co-op/Experiential Education in Science (EESC)****EESC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EESC 2000. Professional Development for Co-op. (1 Hour)**

Introduces students to the Cooperative Education Program and provides them with an opportunity to develop job-search and career-management skills. Offers students an opportunity to perform assessments of their workplace skills, interests, and values and discuss how they impact personal career choices. Students also have an opportunity to prepare a professional-style résumé, learn proper interviewing techniques, and gain an understanding of the opportunities available to them for co-op. Introduces career paths, choices, professional behaviors, work culture, and career decision making. Familiarizes students with workplace issues relative to their field of study and teaches them to use myNEU in the job-search and referral process. Presents co-op policies, procedures, and expectations of the Department of Cooperative Education and co-op employers.

**EESC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EESC 3000. Values, Ethics, and Professionalism in the Sciences. (4 Hours)**

Designed to help students pursuing a science education to begin developing a coherent professional identity. Students examine, articulate, and defend their professional values and use concurrent reflection exercises to create action steps to reach multiple long-term professional goals. Examines ethical dilemmas in science fields in-depth. Offers students an opportunity to learn and utilize theoretical ethical frameworks to discuss a series of case studies and overlay existing ethical codes established by their fields' governing organizations. Students create novel case studies based on real-world events and extrapolate these ethical conversations into the "big ethical and moral issues" facing their fields in the near future (genetic engineering, energy production, etc.). Focuses on the value of lifelong learning through reflective practice, mentorship, professional organizations and conferences, and leadership opportunities in the field.

**Attribute(s):** NUpath Ethical Reasoning

**EESC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EESC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EESC 6400. Pre-co-op Work Experience. (0 Hours)**

Offers students an opportunity to gain necessary skills and practical experience in order to prepare for graduate co-op.

**EESC 6500. Pathways to Professional Success. (1 Hour)**

Offers students an opportunity to develop career management and job search skills for both co-op and full-time postgrad employment; to assess their workplace skills, interests, and values and to discuss how they impact personal career choices; to prepare a professional resumé; and to learn proper interviewing techniques. Explores career paths, choices, professional behaviors, work culture, and career decision making.

**EESC 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated up to eight times.

**EESC 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EESC 6964. Co-op Work Experience. (0 Hours)**

Offers eligible students an opportunity for work experience. May be repeated twice.

**EESC 6965. Co-op Work Experience Abroad. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated twice.

**EESC 9700. Dissertation Fieldwork. (0 Hours)**

Offers students an opportunity to pursue experiential research outside the classroom and outside the university.

**EESC 9701. Dissertation Fieldwork - Half-Time. (0 Hours)**

Offers students an opportunity to pursue experiential research outside the classroom and outside the university.

**Co-op/Experiential Education in Social Sciences and Humanities (EESH)****Courses****EESH 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EESH 2000. Professional Development for Co-op. (1 Hour)**

Introduces students to the Cooperative Education Program and provides them with an opportunity to develop job-search and career-management skills. Offers students an opportunity to perform assessments of their workplace skills, interests, and values and discuss how they impact personal career choices. Students also have an opportunity to prepare a professional-style résumé, learn proper interviewing techniques, and gain an understanding of the opportunities available to them for co-op. Introduces career paths, choices, professional behaviors, work culture, and career decision making. Familiarizes students with workplace issues relative to their field of study and teaches them to use myNEU in the job-search and referral process. Presents co-op policies, procedures, and expectations of the Department of Cooperative Education and co-op employers.

**EESH 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EESH 2994. Internship. (1 Hour)**

Offers an opportunity to document internship work. May be repeated without limit.

**EESH 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EESH 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EESH 6000. Professional Development for Co-op. (0 Hours)**

Presents co-op policies, procedures, and expectations of the College of Social Sciences and Humanities and co-op employers. Students assess their workplace skills, interests, and values and discuss how they impact personal career choices. Offers students an opportunity to learn how to prepare a professional-style resumé, proper interviewing techniques, and to understand what is available to them for co-op. Introduces career paths, choices, professional behaviors, work culture, and career decision making. Covers workplace issues relative to individual fields of study and demonstrates how to use university systems in the job search.

**EESH 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Cooperative/Experiential Education (EXED)

**EXED 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EXED 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EXED 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EXED 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EXED 5945. Experiential Integration Seminar. (0 Hours)**

Guides students in connecting experiential learning to key concepts and skills for the student's degree program. May be repeated twice.

**EXED 6959. Cooperative Education Integrated Experience. (4 Hours)**

Offers a guided learning opportunity to graduate students to accompany their cooperative education work experience. Under faculty supervision and assessment, students engage in one or more projects related to, but distinct from, their work assignments, or explore topics related to their work experience to enhance their experiential learning. May be repeated twice.

**EXED 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Cooperative Education (COOP)

**COOP 3945. Co-op Work Experience. (0 Hours)**

Provides students an opportunity for work experience. Requires sophomore standing or above. May be repeated up to five times.

**Attribute(s):** NUpath Integration Experience

**COOP 3946. Co-op Work Experience--Half Time. (0 Hours)**

Provides students an opportunity for work experience. Requires sophomore standing or above. May be repeated up to five times.

**Attribute(s):** NUpath Integration Experience

**COOP 3947. Co-op Work Experience Abroad--Half Time. (0 Hours)**

Provides students with an opportunity for work experience abroad. Requires sophomore standing or above. May be repeated up to five times.

**Attribute(s):** NUpath Integration Experience

**COOP 3948. Co-op Work Experience Abroad. (0 Hours)**

Provides students with an opportunity for work experience abroad. Requires sophomore standing or above. May be repeated up to five times.

**Attribute(s):** NUpath Integration Experience

**COOP 3949. Internship Exchange. (0 Hours)**

Offers students an opportunity to participate in an internship experience. May be repeated up to five times.

## Cooperative Education - CPS (COP)

**COP 3940. Personal and Career Development. (3 Hours)**

Offers students an opportunity to use co-op experience along with this course to clarify their vision of a successful professional and personal future and identify goals to create that vision; identify strengths, weaknesses, and communication and conflict-management preferences; design a career action plan; and develop and practice articulating professional goals, personal brand, and knowledge and experience gained from co-op. Encourages students to engage in a combination of introspection, critical reflection on experiences in the workplace, and with online collaborative learning and group behavior; learn to identify and analyze career and personal development opportunities in the external environment; and practice communication, relationship-building, conflict management, and leadership skills. This companion course to an internship or co-op requires permission of the CPS Office of Cooperative Education.

**COP 3944. Co-op Work Experience - Half-Time. (0 Hours)**

Offers students an opportunity to engage in work experience that relates to their academic field of study. May be repeated up to four times.

**COP 3945. Co-op Work Experience—Full Time. (0 Hours)**

Offers students an opportunity to engage in work experience that relates to their field of study. May be repeated without limit.

**COP 4946. Global Co-op Work Experience - Full Time. (0 Hours)**

Offers students an opportunity to engage in a global work experience that relates to their field of study. May be repeated without limit.

**COP 5002. Internship. (0 Hours)**

Enables students to engage in an internship to gain practical experience relating to their field of study. May be repeated up to two times.

**COP 6945. Co-op Work Experience—Full Time. (0 Hours)**

Offers students an opportunity to engage in work experience that relates to their field of study. May be repeated without limit.

**COP 6946. Global Co-op Work Experience—Full Time. (0 Hours)**

Offers students an opportunity to engage in a global work experience that relates to their field of study. May be repeated without limit.

## Corporate Innovation (INNO)

### **INNO 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **INNO 2206. Global Social Enterprise. (4 Hours)**

Designed to provide students with an in-depth exposure to entrepreneurship in the social sector, a rapidly growing segment of the global economy. Uses the case method to expose students to leading entrepreneurs who have developed and implemented business models to solve social problems such as extreme poverty, disease, illiteracy, and economic and social dislocation. Focuses on uniquely creative and driven people who have dedicated their lives to making a difference in the lives of others through values-based entrepreneurship.

### **INNO 2301. Innovation!. (4 Hours)**

Designed for students across the entire University who wish to learn about innovation—the creative process, the different types of innovation, how innovations are created, and how innovations can be transformed into commercial reality either as new products or new services and either in startups, existing corporations, and nonprofit entities. Offers students an opportunity to obtain the fundamental insight needed to understand the innovation process and to become a player in it.

**Attribute(s):** NUpath Creative Express/Innov

### **INNO 2304. Industry Disruption and Corporate Transformation. (4 Hours)**

Offers students an opportunity to learn several interrelated frameworks, concepts, and the language necessary to understand and analyze the origin and implications of industry disruptions and the difficulties experienced by incumbent firms as they seek to respond to the changes. Geared toward students who want to become innovation leaders in established companies and lead projects to create and launch new products or services, as well as students who plan to start their own businesses, particularly in high-technology sectors.

### **INNO 2414. The Social Impact of Business. (4 Hours)**

Studies business profitability for investors while sustainably serving its other stakeholders including customers, employees, communities, and the planet. Reviews stakeholder theory as a more sustainable alternative to the traditional focus on maximizing shareholder value. Topics covered include purpose or mission-driven business models (for example, certified B corporations and public benefit corporations); values-based corporate cultures and systems; transparent and accountable governance systems and practices; authentic leadership and moral decision making; sustainable business strategies and practices; and fair compensation structures including profit sharing, broad employee stock ownership, and thriving employee pay and benefits. Studies the impact businesses can have on reducing economic injustice and inequality. Course is based in innovative and entrepreneurial thinking that includes diverse subjects such as strategy, management, finance, law, philosophy, sociology, and psychology.

### **INNO 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **INNO 3303. Digital Platform Strategies and Data-Driven Business Models. (4 Hours)**

Offers a comprehensive toolkit for analyzing, evaluating, or designing new digital, data-driven, and platform-based business models—distilling lessons from leading research and industry best practices. Beyond usual platform theories, addresses key issues of internal operations, ecosystem management, technology architecture, and how and where to deploy data science and AI. Engages students with in-the-cockpit decision making from the perspective of CEOs, product and technology managers, investors, and policymakers, helping students acquire powerful tools and concepts. Course content adheres to a foundation of timeless economic theory and strategic management principles. Offers students an opportunity to sharpen their economic and strategic reasoning, whether they are advanced students or beginners in these areas.

### **INNO 3308. Business Economic History of South Africa. (4 Hours)**

Covers the economic history of modern South Africa through lectures from faculty at the partner university in South Africa and also from the Northeastern professor. Includes the country's transition from apartheid to its present economic and political situation. Offers an opportunity to learn how South Africa has managed to overcome the struggles of its recent past and become one of the leading emerging economies of the world with a flourishing business community. Includes readings in and study of modern South African economics, law, history, politics, and culture.

**Attribute(s):** NUpath Societies/Institutions

**INNO 3309. Funding and Measuring Social Impact. (4 Hours)**

Examines the impact finance and impact measurement landscape. Impact-first innovation and entrepreneurship are rapidly growing segments of the global economy. Studies how impact-first solutions to complex social and environmental problems can be enabled by funding instruments from impact investing, philanthropy, and government aid. Introduces the impact finance and impact measurement landscape from the perspective of a founder. Students develop a theory of change, impact measurement framework, funding strategy, and impact narrative for an existing impact project that is ready to scale.

**INNO 3335. Product Innovation and Portfolio Management. (4 Hours)**

Covers the intersection of project management, product development, and product portfolio management. Focuses on how large corporations develop, manage, and commercialize new products and services. Explores the unique attributes of different industries, such as internet platform-based firms, service-based firms, traditional manufacturing firms, and healthcare.

**INNO 3520. Impact Investing and Social Finance. (4 Hours)**

Explores impact investing, a transformative way to work with money to achieve a more inclusive and sustainable economy. Large investors are entering the world of impact investing, a rapidly emerging space where social and ecological effects of finance are championed over maximizing shareholder value. New investment vehicles such as social impact bonds and Web exchanges are changing the role of financing institutions to better serve the needs of low-income populations around the world. Applies interdisciplinary frameworks, tools, and cases, with hands-on teamwork and guest speakers, to critically examine the field. Offers students an opportunity to learn to develop and test concepts that integrate social responsibility, sustainability, and mutual accountability into current financial and economic systems while expanding social capital markets.

**INNO 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INNO 4225. Growth, Acquisitions, and Alliances. (4 Hours)**

Analyzes whether, why, and how multibusiness corporations expand their operations into new business areas by questioning decisions to grow organically or through mechanisms such as acquisitions or alliances. Uses rigorous case-based discussions, expert readings, and major current events to discuss issues related to the choice of make, buy, or partner. Evaluates how these different corporate entrepreneurial strategies are used to help firms be more competitive and innovative.

**INNO 4504. Integrated Studies in Corporate Innovation. (4 Hours)**

Offers students an opportunity to experience corporate innovation in the classroom. Corporate innovation involves an enterprise experimenting with modern practices, technology, strategies, and opportunities to make its existing business model more competitive in the current marketplace. Students, as a class, represent a specific firm and tackle these corporate innovation challenges by adopting a culture that embraces new technology and actively seeks out ways to enhance the firm's business model. With this proactive approach to corporate innovation, the students can visualize how enterprises can remain agile in the face of rising competition. The goal is to learn how corporations may even identify new opportunities before any startup has a chance to establish itself in the market.

**Prerequisite(s):** ENTR 2301 with a minimum grade of D- or INNO 2301 with a minimum grade of D-

**INNO 4506. Integrated Studies in Social Innovation and Entrepreneurship. (4 Hours)**

Takes a system thinking approach to understanding complex social and environmental problems at local, national, and international levels. Studies the role social innovators and entrepreneurs can play in fostering collaboration at the intersection of social impact, environmental sustainability, and profit maximization. Presents and collectively analyzes through discussion the emerging theories, practices, and frameworks for driving social and sustainable impact. Culminates in a team project where students integrate their learning to deconstruct a complex problem and develop a theory of change that drives sustainable and social impact at scale.

**INNO 4983. Special Topics in Innovation. (4 Hours)**

Examines areas of current interest and special topics in innovation. Employs a mix of lectures, cases, and projects. Topics depend on the instructor. May be repeated once.

**INNO 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INNO 6200. Enterprise Growth and Innovation. (3 Hours)**

Explores the challenges and processes for harnessing technological innovation for new-business development. Integrates technology strategy, innovation in marketing, product development, and organization design for the purpose of enterprise growth. Through readings, cases, and exercises, studies how firms from different industries gain competitive advantage through distinctive products and services, and leverage their technologies and skills into new emerging markets. Also focuses on processes for conceiving, financing, and organizing new ventures.

**INNO 6217. Lean Innovation. (3 Hours)**

Explores how corporate venturing and entrepreneurial teams can quickly and effectively bring new concepts to market. Demonstrates how small technical teams can quickly investigate opportunity spaces, develop and select concepts, and translate these into prototypes. Other topics include industrial design thinking, project teams, prototyping, and commercialization of design. Explores the challenges and solutions to managing a technology-based product within an established corporation and details frameworks on how innovative projects can be inexpensively tested and deployed within the organization.

**INNO 6222. Competing in Dynamic, Innovation-Driven Markets. (3 Hours)**

Reviews the key theories and tools needed to understand how technological change creates new markets and prompts new business models, how technology-based firms can outcompete rivals in fast-growing markets characterized by high uncertainty, and how the evolution of technology in an industry affects the type of firm capabilities needed to succeed over time.

**INNO 6225. Acquisitions, Alliances, and Growth. (3 Hours)**

Offers students an opportunity to analyze whether, why, and how multibusiness corporations expand their operations into new business areas by questioning decisions to grow globally through mechanisms such as acquisitions or alliances. Uses rigorous case-based discussions, expert readings, and major current events to discuss issues related to the choice of make, buy, or partner. Offers students an opportunity to evaluate how these different corporate entrepreneurial strategies are used to help firms be more competitive and innovative.

**INNO 6226. Leading Digital Transformation in Organizations. (3 Hours)**

Examines how the global economy is being transformed by digital and information technologies. Companies increasingly use these technologies to develop and deliver products and services, interact with customers and stakeholders, operate their businesses more efficiently, and disrupt traditional business models with innovative digital solutions. Analyzes how digital technologies offer established companies opportunities to reduce costs, operate more quickly, and offer customers codesign and coproduction options. Studies how firms adapt to new conditions by adopting information technology and the barriers to entry inherent in every organization.

**INNO 6227. Digital Bias in Business. (3 Hours)**

Delves into the societal and ethical challenges companies increasingly face as they confront new technologies. Studies the origins of these challenges and explores how firms can address these important ethical and societal issues as they seek competitive advantage in the marketplace. Examines the unintended consequences of past technological advances and how firms, regulators, and society responded to similar issues in the past. Evaluates a range of current issues with new technologies and explores the extent to which lessons from the past can be applied to current debates. Explores how differences in incentives across organizations influence their stance on new technologies, including the range of solutions they consider when challenges do arise.

**INNO 6230. Platform Innovation. (3 Hours)**

Provides a business perspective on how to design and optimize platform-based business models for growth, value creation, and innovation and a practical analytical toolkit of theories, concepts, and frameworks. Uses case studies from various industries. Many of today's growth enterprises and startups are organized as platforms. Platforms facilitate other actors and support interactions among a wider "ecosystem" of users, services, suppliers, etc., and they have potential for massive growth and value creation. High returns to successful platform business models lead companies to learn to act like platforms. Technology trends toward digitization, big data, automation, etc., accelerate these trends. Aimed at people looking to work within existing companies or those interested in starting or growing new platforms.

**INNO 6240. Strategic Disruption Residency 1. (1 Hour)**

Examines how organizations invest in new technologies to gain a competitive edge. Exposes students to different methods used to improve core business performance through strategic planning, technology road mapping, and market analysis. Offers students an opportunity for hands-on experience with formulating and implementing strategic plans.

**INNO 6241. Strategic Disruption Residency 2. (1 Hour)**

Emphasizes the importance of how to market and sell new products or services, both for internal and external applications. Offers students an opportunity to acquire a comprehensive understanding of how to design strategic revenue strategies that focus on how value is determined and revenues are matched against expense investments. Guides students to explore the challenges and solutions to implementing new innovation processes that leverage digital technologies and collaborative cultures. Includes a mix of research topics, cases, and hands-on learning.

**Prerequisite(s):** INNO 6240 with a minimum grade of C-

**INNO 6242. Strategic Disruption Residency 3. (1 Hour)**

Explores the policies and procedures germane to the internal operation of a technology-driven organization. Emphasizes the principles of risk management and quality control, training and documentation requirements, standards design, and IT support systems. Focuses on choosing, developing, and using operational metrics and analytics to govern a technology-driven operation and mining business intelligence from internal and external sources for use in running that operation.

**Prerequisite(s):** INNO 6241 with a minimum grade of C-

**INNO 6250. Integrated and Applied Technology Leadership Project. (2 Hours)**

Offers three executive seminars in which students build "chapters" that comprise their Integrated and Applied Technology Leadership (IATL) project. Primarily examines the technical and managerial challenges of implementing complex technology-based products—from system modeling, integration of modules, requirements verification, and formal specifications to the definition and overall coordination of the development team's efforts. Covers multiple product environments. Pairs students with mentors based on initial project proposal. Regular meetings with mentors offer students opportunities to refine the project and reinforce the business needs. May be repeated twice.

**INNO 6252. Business Opportunities in Sustainable Smart City Initiatives. (3 Hours)**

Explores technology's role in addressing urban sustainability. Examines the impact of technology, designing profitable smart city projects, and key factors influencing corporate involvement in these initiatives. Studies the navigation of public sector processes for mutual benefit. Topics include smart traffic, safety, housing, the environment, education, healthcare, economic development, and tourism.

**INNO 6253. Managing the Metaverse. (3 Hours)**

Explores the foundations of the metaverse and its impact on technology, society, and commerce. Analyzes the historical context, augmented and virtual reality, alternate realities, and the potential for a fully realized metaverse. Utilizes transmedia storytelling as a lens to understand how these dimensions shape the human experience and offers opportunities for creative and profitable interactions.

**INNO 6254. Technology and the Law. (3 Hours)**

Introduces the intersection of law and technology, focusing on legal principles impacting business decisions. Examines how to make informed choices and collaborate with lawyers. Emphasizes understanding key legal issues, effective interaction with legal professionals, and fostering the capability to discuss and explain issues within business teams.

**INNO 6300. Managing a Technology-Based Business. (3 Hours)**

Covers topics specific to managing a business or a strategic business unit within a firm. Considers the special issues related to technology-based firms. Topics include creating a culture, operations planning, staffing for technical excellence, dealing with technology vendors, dealing with advisers, supply chain management, and writing operations plans. Open to first-year graduate students.

**INNO 6318. Innovation Driven Strategy. (2 Hours)**

Introduces a number of entrepreneurship and innovation topics, including innovation and entrepreneurship as a value-creating activity for economies and firms; types of innovation (technological, process, products, business models); fundamentals of product development (design thinking, rapid prototyping, ethnography); startup creation and articulating a value proposition; the role and traits of the entrepreneur; maximizing odds of success and minimizing odds of failure; growing the startup and creating a market; finding or creating the right niche; pivoting and judo strategy; lean startup approach; innovation in established firms and resistance to change; organizational inertia; business model change; and technological discontinuities.

**INNO 6400. Enterprise Growth and Innovation. (2 Hours)**

Explores the challenges and processes for harnessing technological innovation for new-business development. Integrates technology strategy, marketing innovation, product development, and organization design for the purpose of enterprise growth. Uses readings, cases, and exercises to study how firms from different industries gain competitive advantage through distinctive products and services and leverage their technologies and skills into new emerging markets. Focuses on processes for conceiving, financing, and organizing new ventures.

**INNO 6401. Blockchain AI and IT. (3 Hours)**

Covers the design of blockchains and their applications in healthcare, media, financial services, information security, supply chain logistics, and enterprise systems. Introduces the technology underlying blockchains and related implications for IT, analytics, business models, and business processes. Studies a variety of topics within the domain of blockchain technology and its enablement of machine learning. Demonstrates and shares business implications through faculty-led discussion and synthesis. Readings, content, and lectures are context and raw materials.

**INNO 6402. Creating Value in the Experience Economy. (3 Hours)**

Introduces students to ideas, frameworks, and design principles for creating greater economic value for consumers and in B2B situations. Explores the full "Progression of Economic Value" beginning with fungible commodities (the basis of the agrarian economy), to tangible goods (the industrial economy), to intangible services (last century's service economy), shifting into memorable experiences—the basis of the experience economy.

**INNO 6403. Cybersecurity Response Policy and Practice. (3 Hours)**

Introduces the tools needed to build, deliver, and implement a cybersecurity strategy, obtain board consensus around the proposed strategy, and develop an associated "cyber playbook" to respond to security incidents. Focuses on cybersecurity strategy and risk framework from the perspective of the board and executive team. Offers students an opportunity to transition from a strategy and planning perspective to driving cybersecurity tactically with security teams and the business, including security awareness and integration of security controls. Examines how to apply tactical knowledge of incident response and reporting via a scenario-based experiential exercise with role-playing in a simulated cybersecurity crisis situation derived from real-world scenarios.

**INNO 6404. Database Platform Design. (3 Hours)**

Offers students an opportunity to enhance their technology leader skills by developing a working knowledge of data technology concepts such as NoSQL, Hadoop, and distributed processing. Explores metaconcepts to overcome common stumbling blocks and foster collaboration between technology and analysts when defining new work. Students work in groups and individually to experience the frustrations and resolutions of developing a business requirements document for an analytics project. Requires students to present group deliverables each week and to participate in discussions that focus on the process of working on both sides of relationships with technology leads and business users.

**INNO 6405. Enterprise Information Security: Threats and Defenses. (3 Hours)**

Examines tactical orientation following identification of a security threat, at the point of requiring immediate analysis and response to mitigate damage and loss to an organization. Reviews the strategic design of a connected defensive structure built of tools, procedures, and integrations. Focuses on business model relationships to security threat profiles, including managing vulnerability introduced through mergers and acquisitions and active directory migrations. Studies service and administrative account management and other aspects of network design and management. Offers students an opportunity to investigate recent/current cases and to devise countermeasures aimed at incident prevention and effective cyber incident response management and monitoring.

**INNO 6406. Leading Disruptive Change in a Digital Economy. (3 Hours)**

Focuses on the impact of information technology on an organization's transformative objectives. Studies concepts relating to how to integrate IT as the key driver for business process change, for continuous improvement in incremental gains, and for selective reengineering to effectuate substantial breakthroughs in process performance. Offers students an opportunity to develop an understanding of how technology has a push effect on an organization's processes and of the various factors that must be in synch to facilitate such an effect.

**INNO 6408. Raising Capital. (3 Hours)**

Explores multiple strategies for students to launch new ventures as entrepreneurs or intrapreneurs. Focuses on the assessment of business models, funding strategies, team building approaches, and go-to-market examples for new ventures. Offers students an opportunity to draw upon previous academic and professional experience in cross-disciplinary ideation, finance, business strategy, law, market research, and organizational behavior to actualize new venture ideas. Culminates in a new venture pitch to mentors and peers who may include serial entrepreneurs, venture capitalists, startup advisors, and individuals with C-level corporate experience.

**INNO 6409. Innovation Portfolio Management. (4 Hours)**

Focuses on the strategic and tactical aspects of managing product innovation and portfolios within diverse organizational contexts. Explores methodologies such as stage-gate, lean startup, and agile practices while analyzing challenges in industries ranging from manufacturing to healthcare. Key topics include opportunity identification, customer needs analysis, technology roadmapping, and financial planning.

**INNO 6411. Product Innovation Management. (1 Hour)**

Explores advanced principles in product innovation management. Focuses on integrating design thinking, innovation strategy, and portfolio management. Through experiential learning, offers students an opportunity to develop skills in assessing product life cycle stages, aligning innovation portfolios with strategic goals, and applying metrics for data-driven decision making.

**INNO 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Counseling and Applied Educational Psychology (CAEP)

**CAEP 1280. Introduction to Mindfulness. (4 Hours)**

Explores modern mindfulness practices and how these practices were derived from Eastern spiritual teachings, including Buddhism and Hinduism. Describes the current literature related to potential health and wellness outcomes of a mindfulness practice. Examines various meditation techniques, as well as accompanying practices such as yoga and breath work. Focuses on developing and practicing daily mindfulness using a highly experiential approach. Offers students an opportunity to learn and discuss the foundations on which such practices are based.

**Attribute(s):** NUpath Interpreting Culture

**CAEP 1290. Personal Behavior Change. (4 Hours)**

Designed to help students to develop an awareness of and strategies for the management of their behaviors. Examines how behavior is influenced via operant and respondent conditioning, motivating variables, and reinforcement and punishment. Requires students to design and implement a self-management project that involves goal setting, measuring behavior, selecting and implementing an intervention based on the research, and monitoring and evaluating progress. Offers students an opportunity to develop skills to support their goals, including time management and effective communication.

**CAEP 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CAEP 2012. Health Psychology: An Introduction. (4 Hours)**

Introduces the field of health psychology, which studies the role of psychology in health, illness, and healthcare. Topics include sustaining and promoting health, as well as experiencing illness and the body. Discusses focusing on people's behaviors, perceptions, emotions, and understandings of health and illness, within the contexts of relationships and culture. Also discusses how the theories and concepts of health psychology are instrumental in health promotion and prevention (including relevance to students' own well-being). Specific themes include the biopsychosocial model of health; stress, coping, and social support; health-promoting and health-risk behaviors; behavior change theories and approaches; gender and health; health disparities; and the relevance of health psychology for health promotion.

**CAEP 2050. Health Systems, Services, and Education in Ghana. (4 Hours)**

Explores healthcare systems, services, education, and training in Ghana, West Africa. Discusses Ghana's medical facilities, services, training institutions, and policies that affect prenatal care, women's health, chronic and communicable diseases, traditional medicine, and general health issues. Explores preventative, immediate, and remedial care and healthcare delivery issues and challenges in Ghana. This is a Dialogue of Civilizations course.

**Attribute(s):** NUpath Integration Experience

**CAEP 2060. Health and Well-Being in Ghana. (4 Hours)**

Explores issues involving health and well-being in a Ghanaian context. Utilizes frameworks of well-being to examine ways in which Ghanaian healthcare institutions provide services to its citizenry. Offers students an opportunity to engage in a comparative analysis of college student health and well-being to that of students in U.S. institutions of higher education.

**Attribute(s):** NUpath Societies/Institutions

**CAEP 2101. Behavioral Assessment and Treatment of Health Problems in the 21st Century. (4 Hours)**

Focuses on the application of principles of behavior analysis to address health problems in the 21st century, such as obesity, addiction, and adherence to medical procedures. Offers students an opportunity to develop an understanding of basic behavioral principles and how those principles are applied to assess and treat health problems. Compares and contrasts a behavioral approach with other traditional methods in health psychology. Emphasizes systems of measurement, evaluation (single subject design), and treatment. Studies how a behavioral approach is integrated into a multidisciplinary treatment plan.

**CAEP 2280. The Yoga Tradition in Nepal: Philosophy, Methods, and Practice. (4 Hours)**

Introduces key aspects of the yoga tradition including preclassical, classical, postclassical, and modern aspects. Explores teachings from both the Hindu and Tibetan traditions, including the eight limbs of yoga, Hatha Yoga, and Yantra Yoga practices. Describes the research on mental and physical health outcomes from a regular yoga practice.

**Attribute(s):** NUpath Integration Experience, NUpath Interpreting Culture

**CAEP 2290. The Yoga Tradition: Philosophy, Methods, and Practice. (4 Hours)**

Introduces preclassical, classical, postclassical, and modern aspects of the yoga tradition. Explores teachings from both the Hindu and Tibetan traditions, including the eight limbs of yoga, Hatha Yoga, and Yantra Yoga practices. Describes the research on mental and physical health outcomes from a regular yoga practice.

**Attribute(s):** NUpath Interpreting Culture

**CAEP 2460. Special Education. (4 Hours)**

Surveys the characteristics and the development and learning needs of children and youth with special needs. Reviews legislation and current trends, with an emphasis on integration and full inclusion of children and youth with special needs in regular education settings and also in the community. Introduces principles of assessment and intervention and strategies for the development of individualized education programs (IEPs).

**CAEP 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CAEP 2991. Research in Counseling and Applied Educational Psychology. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated once.

**CAEP 3200. Childhood Adversity and College Attainment. (4 Hours)**

Introduces students to Adverse Childhood Experiences (ACE) and their prevalence in the childhoods of certain college student populations. Examines how these potentially traumatic events that occur during the ages of 0–17 are linked to chronic health problems, mental illness, and substance misuse in adulthood. Studies how the manifestation of ACE during the college years has implications for student development theory application and administration of services and programs on campuses, as well as ACE's impact on education, job opportunities, and college student degree attainment. Explores the classifications of ACE—pandemic, natural disaster, terrorist attack, or racial and social injustice—and the possible implications of living through, making life adjustments, or absorbing constant media coverage as a result of these experiences.

**Attribute(s):** NUpath Difference/Diversity

**CAEP 3310. Say It Loud: The Black Power Movement and Higher Education. (4 Hours)**

Explores the impact of the Black Power movement on American colleges and universities. Examines the history of the movement and its relationship to the civil rights movement and the various impacts of Black Power on contemporary higher education. Traces how the movement led to distinct ideologies, scholarship, practices, and terminology that provided new lenses through which institutions of higher education viewed Negroes in terms of the preservation, transmittal, and enrichment of their culture by means of instruction and scholarly and scientific work. Explores Negro college students' adoption of a Black identity and making demands on campuses that manifested in curricula, programs, and services that represented this identity.

**Attribute(s):** NUpath Difference/Diversity

**CAEP 3480. Counseling Theories and Practice. (4 Hours)**

Surveys major theoretical approaches to counseling. Provides training and practice in listening skills to aid in the development of facilitative responses. Combines didactic representations and experiential activities to assist in understanding and implementing a variety of counseling approaches. Requires prior completion of one introductory social science course.

**CAEP 3485. Mental Health and Counseling. (4 Hours)**

Explores those characteristics that constitute a mentally healthy person, factors in society that impact emotional health, the mind-body relationship, stress, and ways to achieve a higher level of emotional well-being. Offers students the opportunity to work in triads, small groups, and large group discussions. Role-play is utilized where appropriate. Requires prior completion of one introductory social science course.

**CAEP 3899. Relationships in College. (4 Hours)**

Explores the interpersonal interactions of traditional-age college students with their peers, faculty, roommates, romantic partners, and family. Investigates the implications of relationships on the college student's well-being, growth, and development. Requires students to discuss and analyze the impact of technology on relationships and how it enhances or diminishes effective communication in college. Emphasizes the importance of cultivating relational skills that can be applied in students' postacademic lives.

**CAEP 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CAEP 4525. Introduction to Professional Psychology. (4 Hours)**

Offers students an opportunity to gain an understanding of the roles and functions psychologists have in different work settings and how psychological theory, techniques, and research can be applied in real-world situations. Studies the several different areas of professional psychology, including counseling psychology, school psychology, clinical psychology, early intervention, applied behavior analysis, and organizational psychology. Students also have an opportunity to learn how to prepare themselves for graduate school and how to put together an application to graduate school programs. Intended for students considering graduate study in psychology or allied disciplines.

**CAEP 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CAEP 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**CAEP 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**CAEP 5150. Early Intervention: Family Systems. (3 Hours)**

Introduces students to the theory and practice of family interventions with a diverse population including infants, toddlers, and preschoolers with special needs. Discusses family systems, developmental, coping, crisis, and ecological theories and practices. Teaches assessment and intervention skills. Integrates theories of exceptionality as they pertain to family systems into course material.

**Attribute(s):** NUpath Difference/Diversity

**CAEP 5151. Early Intervention: Infant and Toddler Development, Risk, and Disability. (3 Hours)**

Introduces students to the major theories of development and their implications for intervention. Presents and discusses infant/toddlers' development, risk, and disability in the areas of cognition, communication, motor skills, social/emotional development, and adaptive skills, and considers variation in development as a result of multiple factors. Is team-taught by professors drawn from school psychology, special education, speech-language pathology, counseling psychology, nursing, and physical therapy.

**CAEP 5153. Early Intervention: Assessment and Intervention. (3 Hours)**

Covers assessment models and the multidomain tests used in early intervention. Students become familiar with informal and formal instruments used in different areas including cognition speech and language, motor, and social/emotional domains. Explains the process and responsibilities for the writing of individualized service plans (ISPs), as well as variety of intervention models, methods, and strategies to be implemented in natural environments. Is taught by professors drawn from special education, speech-language pathology, counseling psychology, nursing, and physical therapy. Students participate in Northeastern's Global Early Intervention Network.

**CAEP 5330. Applied Animal Behavior Analysis. (4 Hours)**

Introduces the reverse translation of behavior from the animal laboratories of Pavlov and Skinner to the world of human behavior change via applied behavior analysis, and back to the socially significant behavior of animals that live in proximity to humans. Discusses how to identify problem behaviors of dogs, cats, and other animals and how to ethically assess and analyze these behaviors through this lens, as well as how to design an ethical course of intervention.

**CAEP 5876. Mental Health Education and Program Planning. (3 Hours)**

Describes dominant models of health education and program planning for mental health. Emphasizes the importance of collaboration with end users, stakeholders, and the development of partnerships. Highlights cross-cultural differences in health service systems and underserved populations.

**CAEP 5877. Research Methods in Applied Psychology. (3 Hours)**

Provides an opportunity for students to learn basic concepts in applied research in psychology, education, and related behavioral and mental health fields. Provides a solid foundation for students to conceptualize the purpose, process, and key methods of applied research. Introduces relevant statistical topics within the context of their respective designs.

**CAEP 5878. Pediatric Psychology. (3 Hours)**

Introduces the field of pediatric psychology, which studies the role of psychology in health, illness, and healthcare among children and adolescents. Reviews various psychological, emotional, and behavioral factors associated with onset, course, and management of specific pediatric illnesses. Explores related evidence-based prevention and treatment interventions.

**CAEP 5879. Trauma and Mental Health. (3 Hours)**

Introduces the foundations of trauma theory to offer students a trauma-sensitive perspective to the continuum of practice from policy making to direct client service. Reviews the neurophysiology of trauma. Examines causative factors and evidence-based treatments of trauma-related mental health issues (e.g., PTSD). Reviews current theory and research on topical areas related to trauma including intimate partner violence, child abuse, sexual assault, school and community violence, war and terrorism, and other emerging trauma issues.

**CAEP 5880. Clinical Skills in Context. (3 Hours)**

Offers non-clinical professionals an opportunity to develop effective communication skills for working with individuals with mental health disorders and/or trauma histories. Provides opportunities to apply these skills in context via relevant, real-world scenarios and decision-making situations. Covers key clinical communication techniques and how to integrate trauma-informed principles into their daily interactions. Focuses on effective communication and relationship-building skills with children, adolescents, and families or adults. Combines theoretical knowledge, evidence-based strategies, and practical applications to enhance interpersonal interactions.

**CAEP 6100. Prevention and Intervention: Evidence-Based Practices. (3 Hours)**

Introduces the foundational principles and methods that guide research on prevention and intervention for mental health disorders. Reviews prevention approaches for specific public mental health topics, including intervention theory and clinical trial design, the role of community collaboration and engagement, the utility of interventions that operate at multiple ecological levels, and the complexities involved in the implementation and dissemination of evidence-based practice for mental health across the life span.

**CAEP 6110. Etiology-Psychopathology Across the Life Span. (3 Hours)**

Examines the major mental disorders across the life span, emphasizing the current thinking regarding etiology and essential features in the context of public health. Reviews diagnosis and classification; epidemiology; and the genetic, neurobiological, cultural, and social factors that relate to the etiology and maintenance of mental health disorders. Addresses innovative approaches and methods to integrate current psychopathology research, mental health frameworks, and public health frameworks.

**CAEP 6200. Introduction to Counseling: Theory and Process in an Ecological Context. (3 Hours)**

Provides an overview of counseling and psychology from the ecological perspective. Covers the history, theories, and process of counseling across forces within psychology and across individuals (children and adults), groups, and families. Includes an introduction to counseling skills.

**CAEP 6201. Introduction to Assessment. (3 Hours)**

Introduces testing and assessment in psychology and education including group achievement tests. Covers uses of tests in society, the politics and economics of tests, types of tests, test statistics, reliability, validity, item analysis, test construction, new movements in testing, and applications. Introduces descriptive statistics as a basis for understanding the statistical basis for establishing norms, scales, and for understanding approaches to scoring.

**CAEP 6202. Research, Evaluation, and Data Analysis. (3 Hours)**

Introduces topics in research and evaluation from a consumer perspective. Covers types of research studies and methodologies, philosophical bases for perspectives, research design, evaluation and outcomes assessment, data analysis techniques, clinical and qualitative approaches, and interpretation of research findings.

**CAEP 6203. Understanding Culture and Diversity. (3 Hours)**

Works from a broad definition of culture and diversity. In addition to traditional culture and ethnic classifications, examines disability, poverty, and gender as culturally defining factors. Also explores the dynamics of culture in social systems, with the perspective of valuing differences in society and sociocultural forces impinging on culture from the ecological perspective.

**CAEP 6206. Learning Principles. (3 Hours)**

Provides an overview of the theories of learning, cognition, and emotion. Introduces the major theories and relates them to applications and interventions in psychology and education.

**CAEP 6218. Infant, Child, and Adolescent Development. (3 Hours)**

Provides an overview of development from birth through late adolescence. Covers the major theories of human development from a culturally informed, gender-sensitive ecological orientation. Reviews stages and theories of development from an interdisciplinary perspective and related to implications for learning. Examines cognitive, language, social/emotional, play, and physical aspects of development.

**CAEP 6220. Development Across the Life Span. (3 Hours)**

Identifies and addresses culturally and gender-sensitive developmental issues throughout the life span, from the conventional stages of childhood through the end of life. Discusses ethnic, economic, gender, relational, and sexual identities, as well as health-medical and aging concerns.

**CAEP 6222. Human Sexuality. (3 Hours)**

Designed for the twenty-first century and the critical issues that have evolved in the field. Includes current information on issues in human sexuality (and acts as a forum for the discussion of current trends), which may include HIV/AIDS, abortion, ethics and morality in genetic engineering, sex education in the school and home, teen sexuality and pregnancy, personal behaviors, social aspects of acquaintance rape, early sexual experiences, divorce, and remarriage. Allows for the development of counseling skills needed to deal with various issues.

**CAEP 6235. Vocational, Education, and Career Development. (3 Hours)**

Focuses on the interactions of economic needs, work, class, education, and contemporary social trends as part of human development in a sociohistoric ecological context.

**CAEP 6242. Psychopathology: Diagnosis and Treatment Planning. (3 Hours)**

Identifies categories of human difficulty and abnormal behavior through current DSM terminology. Is based in a cultural and gender competent bio-psycho-social model over the life span. Discusses both preventive and individual interventions for each category. Also introduces treatment planning and treatment guidelines.

**CAEP 6247. Child and Adolescent Psychopathology. (3 Hours)**

Covers DSM-IV and major forms of psychopathology including the neuroses (obsessional states, hysteria, anxiety states, and phobias); the psychoses (schizophrenia, mania, depression, and paranoia); psychosomatic, sociopathy, conduct disorders; and organic disorders. Discusses the relationship between categories of special education disabilities (emotional impairment, autism) and DSM-IV.

**CAEP 6250. Individual Interventions. (3 Hours)**

Focuses on a variety of individually focused interventions: standard techniques used to achieve change goals as well as crisis intervention and prevention. Use of multimodal interventions (for instance, expressive, action) are joined with specific problems that individuals might face. Also addresses crisis intervention, solution-focused treatment planning, and promoting resiliency and activism.

**CAEP 6260. Community Counseling Psychology. (3 Hours)**

Addresses organizational and systems impact, stressors, and change efforts. Draws from the community, consultation, organizational, prevention, and social psychology literature. Considers understanding of health promotion in social and institutional contexts. Also explores crisis, coping, and social change.

**CAEP 6282. Ethics and Professional Development. (3 Hours)**

Addresses professional development and mental health counseling issues. Also considers professional ethics from ACA, APA, and FTI, with emphasis on the professional functioning of counselors. Discusses current issues in the practice and control of mental health. Also addresses the role of professional organizations and state licensing.

**CAEP 6283. Brief Therapies. (3 Hours)**

Discusses brief forms of therapy and counseling. Addresses therapies with each of the theoretical four forces. Discusses advantages and disadvantages of brief therapy. Considers the fit of the therapy with the person or client system as well as the goals and context. Also explores empirical, ethical, pragmatic, and political viewpoints.

**Prerequisite(s):** CAEP 6200 with a minimum grade of B

**CAEP 6286. Family Counseling Interventions. (3 Hours)**

Examines the role and social construction of families. Includes a brief overview of theoretical perspectives and especially considers the more recent implications of feminist and multicultural critiques. Discusses relationship building and specific interventions with families in terms of appropriate use of clinical, ethical, and gender/race-ethnic/class competencies.

**Prerequisite(s):** CAEP 6200 with a minimum grade of B

**CAEP 6287. Group Counseling. (3 Hours)**

Covers group design, dynamics, and leadership as well as their application in a range of mental health group activities. Since the conventional theoretical orientations have been covered in the theory course (CAEP 6200), this course approaches group work through a broader perspective. For example, while expressive groups based in a humanistic tradition and insight gained through psychodynamic and cognitive traditions are in the course, such recent developments as adventure and psychoeducation group work are also included.

**CAEP 6324. Programmed Learning. (3 Hours)**

Introduces the importance of programming for effective learning, including for students with autism spectrum disorders. Stresses goals shared by behavior analysts and educators. Employs evidence-based teaching procedures for training complex behavior. Emphasizes the need for assessment and data analysis for programming. Focuses on procedures based on establishing and transferring stimulus control, including establishing equivalence classes.

**Prerequisite(s):** CAEP 6331 with a minimum grade of B

**CAEP 6326. Behavioral Concepts and Principles. (3 Hours)**

Introduces concepts and principles that make up the foundation of behavior science. Identifies naturally existing examples of the basic principles of behavior. Requires demonstrated mastery of behavioral explanations of why behaviors occur. Contrasts behavioral descriptions with other philosophical conceptualizations.

**CAEP 6327. Behavior Assessment. (3 Hours)**

Expands on key elements of behavior assessment including systematic assessment of preferences and reinforcers, and assessment of behavior function through indirect methods, direct methods, and systematic manipulations.

**Prerequisite(s):** (CAEP 6326 with a minimum grade of B or CAEP 6326 with a minimum grade of B or CAEP 6326 with a minimum grade of B);  
(CAEP 6329 with a minimum grade of B or CAEP 6329 with a minimum grade of B or CAEP 6329 with a minimum grade of B )

**CAEP 6328. Single-Case Research Design. (3 Hours)**

Introduces single-case experimental designs and methods to define and measure behavior. Offers students an opportunity to learn how to measure behavior and design experimental arrangements to analyze relationships between dependent and independent variables.

**CAEP 6329. Ethics for Behavior Analysts. (3 Hours)**

Offers students an opportunity to develop competence in a comprehensive overview of the legal and ethical issues in applied behavior analysis, including design and implementation of applied behavior analytic services and applied research. Discusses ethical issues in staff training, performance management, and program evaluation.

**CAEP 6331. Advanced Learning Seminar 1. (3 Hours)**

Discusses a broad overview of teaching and learning topics with in-depth focus on specific technologies geared toward increasing behavior change. Identifies the principles involved in learning and how to apply those principles to enhance skill acquisition. Employs evidence-based procedures to systematically increase a behavior. Evaluates the effectiveness of the behavior change procedures throughout the semester.

**Prerequisite(s):** (CAEP 6326 with a minimum grade of B or CAEP 6326 with a minimum grade of B or CAEP 6326 with a minimum grade of B ); (CAEP 6328 with a minimum grade of B or CAEP 6328 with a minimum grade of B or CAEP 6328 with a minimum grade of B )

**CAEP 6332. Advanced Learning Seminar 2. (3 Hours)**

Explores advanced behavior analytic topics, and practices applying basic principles to more complex scenarios. Extends basic behavior analytic conceptualizations and services, and investigates extensions of the behavioral sciences to areas other than work in special education.

**Prerequisite(s):** CAEP 6331 with a minimum grade of B or CAEP 6331 with a minimum grade of B

**CAEP 6334. Applied Programming Seminar 1. (3 Hours)**

Focuses on the systematic application of principles of behavior analysis to interventions in applied settings. Allows students to design, test, and evaluate instructional programs for remedial application to behavior problems and to test instructional theory. Emphasizes the relationship between behavioral assessment and behavioral intervention. Provides supervision through the weekly research and data seminar in collaboration with the student's project adviser.

**Prerequisite(s):** CAEP 6327 with a minimum grade of B or CAEP 6327 with a minimum grade of B or CAEP 6327 with a minimum grade of B

**CAEP 6335. Applied Programming Seminar 2. (3 Hours)**

Focuses on the practical issues surrounding development of an applied thesis research topic. Students develop their thesis topic and prepare a written proposal for their thesis research. Students present the initial thesis proposal and periodic updates during the weekly seminar. Thesis committee members are invited to attend their students' presentations to provide feedback and critique of the developing proposal.

**Prerequisite(s):** CAEP 6334 with a minimum grade of B

**CAEP 6336. Systematic Inquiry 1. (3 Hours)**

Requires each student to collect a comprehensive bibliography on a significant topic in applied behavioral research and complete a thorough written review. Emphasizes the integration and analysis of experimental findings and theoretical foundations of the research area, critical evaluation of current research, and the identification of potentially fruitful future research. Frequent presentation of current research by students helps develop their oral communication skills and prepares them for becoming contributing professionals in the field of behavior analysis.

**Prerequisite(s):** (CAEP 6331 with a minimum grade of B or CAEP 6331 with a minimum grade of B ); CAEP 6334 with a minimum grade of B

**CAEP 6338. Clinical Practice Supervision. (1-3 Hours)**

Offers a seminar for supervision of a clinical experience in practicum, internship, or fieldwork. Meets on campus with instructor/supervisor and complements individual supervision at the practice site. May be repeated for up to 6 total credits.

**CAEP 6341. Behavioral Interventions. (3 Hours)**

Provides a broad overview of teaching and learning based on behavioral principles. Examines specific behavioral technologies geared towards both increasing and decreasing behavior. Emphasizes the relationship between assessment and function-based interventions to treat problem behavior and teach new skills.

**Prerequisite(s):** CAEP 6326 with a minimum grade of B ; CAEP 6329 with a minimum grade of B

**CAEP 6342. Consultation, Supervision, and Management. (3 Hours)**

Addresses topics related to behavioral supervision, consultation, and staff/program evaluation in human service organizations, including performance analysis and management, staff training, behavioral systems analysis, organizational culture, and culturally responsive leadership. Explores essential components of organizational behavior management.

**CAEP 6343. Radical Behaviorism and Verbal Behavior. (3 Hours)**

Explores the foundations of the philosophy of radical behaviorism and its extension to B. F. Skinner's analysis of verbal behavior. Examines explanations of complex human behavior, including verbal and nonverbal behavior, from differing behavioral perspectives. Offers students an opportunity to evaluate how B. F. Skinner's conceptual writings relate to current behavior analytic theory, research, and practice.

**Prerequisite(s):** CAEP 6326 with a minimum grade of B

**CAEP 6344. Experimental Analysis of Behavior. (3 Hours)**

Offers students an opportunity to obtain the skills to interpret basic research in behavior analysis. Examines concepts and principles of behavior from an experimental perspective, as well as the causes of complex behavior. Practices developing experimental arrangements to evaluate behavioral principles and analyzing data through cumulative records and single-case experimental design.

**Prerequisite(s):** CAEP 6326 with a minimum grade of B ; CAEP 6328 with a minimum grade of B

**CAEP 6345. Promoting Youth Academic Success in Schools. (3 Hours)**

Focuses on learning problems in relation to developmental tasks and curriculum frameworks including reading and writing. Examines the types and causes of learning problems and individual learning styles from constructivist, neuropsychological, and ecological perspectives. Reviews methods for assessment of physical, emotional, intellectual, and social development in childhood and adolescence. Emphasizes special education legislation and current service delivery programs.

**CAEP 6346. Behavior Change for Individuals and Communities. (3 Hours)**

Offers students an opportunity to explore and practice methods to effectively change their own behavior, with the aim to create greater change in the world. Explores the impact of inadvertent behavior change and its potential effects. Emphasizes behavior change that will affect other individuals, communities, cultures and systems, or entire environments.

**CAEP 6347. Behavior Management. (3 Hours)**

Covers theory, research, and practice pertaining to management of behavior in preschool, elementary, and high school classrooms. Presents development of practical behavioral interventions using a systematic problem-solving process (including functional behavioral assessment). Includes skills and techniques of preventing and remediating behavior problems.

**CAEP 6348. Systems in Schools 1. (1 Hour)**

Explores a culturally responsive, integrated (academic plus behavioral), multi-tiered system of support within schools (MTSS). Emphasizes a data-based individualization framework to systematize the process of intensifying and adapting evidence-based interventions to meet individual needs of children and youth with disabilities.

**CAEP 6349. Systems in Schools 2. (1 Hour)**

Continues CAEP 6348. Explores a foundation for understanding a culturally responsive, integrated (academic and behavioral), multitiered system of support within schools. Students design an individualized and integrated academic and behavior plan for children and youth, monitor progress using graphic displays, evaluate outcomes, and discuss intervention adaptations according to data. Emphasizes using a data-based individualization framework that systematizes the process of intensifying and adapting evidence-based interventions to meet individual needs of children and youth from an interdisciplinary framework.

**Prerequisite(s):** CAEP 6348 with a minimum grade of B

**CAEP 6350. Introduction to Cognitive Assessment. (3 Hours)**

Introduces cognitive assessment and the relationship of cognitive theories to assessment. Also includes practice in administering and interpreting specific tests of cognitive functioning, such as the Wechsler Scales and the Woodcock-Johnson.

**CAEP 6352. Personality Assessment. (3 Hours)**

Administers and interprets projective tests, behavior rating scales, and personality tests. Offers advanced level of integrating results from different measures in report writing.

**CAEP 6353. Curriculum-Based Assessment and Data-Based Decision Making. (3 Hours)**

Presents curriculum frameworks (reading, mathematics), developmental sequences (language), socialization, and life skills as areas of learning breakdown. Focuses on collection and use of data from curriculum-based procedures that evaluate a child's current level of understanding and performance in one of these areas, determination of intervention goals, formulation of individualized education programs (IEPs), development of instructional plans, and monitoring progress using curriculum-based measurements.

**CAEP 6354. Social, Emotional, and Behavioral Assessment. (3 Hours)**

Uses a problem-solving framework designed to help students to develop skills in identifying common school-based social, emotional, and behavioral problems and designing targeted assessment plans. Offers students an opportunity to gain experience in the administration, scoring, and interpretation of relevant measures designed to assess children's and adolescents' social, emotional, and behavioral functioning; in the synthesis of multisource/multimethod data; and in psychological report writing.

**CAEP 6360. Consultation and Program Evaluation. (3 Hours)**

Overviews different consultation theories including behavioral, psychodynamic, and systems perspectives. Offers a focus on skill development with respect to a broad-based and pragmatic approach to client-centered behavioral consultation. Uses computer networks and e-mail in client-centered and peer consultation. Offers evaluation of the implementation and outcomes of consultation and related service delivery programs.

**CAEP 6365. Seminar in School Psychology. (3 Hours)**

Covers the philosophical, historical, technical, and school administrative issues contributing to the professional identity of school psychologists. Emphasizes ethical standards, public policy, and legislation that impact school psychology.

**CAEP 6375. Substance Use and Treatment. (3 Hours)**

Covers use, abuse, and treatment of both legal and illegal psychoactive drug agents. Includes an introduction to psychotropic medications, overview of illicit substance use, differential substance abuse, interventions and treatment, and related social issues.

**Prerequisite(s):** CAEP 6200 with a minimum grade of B-

**CAEP 6380. Seminar in Feminist Psychology. (3 Hours)**

Looks at sex-gender socialization and role ascription in the development of women and men. Examines feminine and masculine gender role stereotypes and constructs in mental health theory, procedures, and practices. Introduces the variety of feminist standpoints and explores their impacts on the conceptualization of health and healing. Presents major points in feminist therapy and psychology. The student examines selected areas in-depth within this course.

**CAEP 6390. History and Systems of Psychology. (3 Hours)**

Examines the development of psychological theories in the context of western intellectual development. Attends to the underlying epistemological assumptions and historical and cultural forces on psychology. Also emphasizes some of the potential contributions to psychology of other world civilizations and to paradigmatic strengths and limits.

**CAEP 6394. Advanced Multicultural Psychology. (3 Hours)**

Provides critical analyses of "universalist" perspective counseling and development theory. Explores a variety of implications for culturally competent psychological work. Addresses process, procedures, and interventions as well as theory and inquiry. Focuses on individual and cultural differences in counseling and professional psychological services.

**Prerequisite(s):** CAEP 6203 with a minimum grade of B

**CAEP 6399. Clinical Skills in Counseling Psychology. (3 Hours)**

Develops self-awareness, communication skills, and therapeutic and practice procedures.

**CAEP 6400. Prepracticum in School Psychology. (1 Hour)**

Requires a minimum of 75 hours of school-based experience. Designed to orient school psychology graduate students to the school psychology profession and the practicum. Offers students an opportunity to understand the role of the school psychologist and the school environment. Seeks to familiarize students with the range of different school psychological services and the range of students who receive services from school psychologists, including students from different cultures and students with and without disabilities. Emphasizes observational learning. Students must complete the entire prepracticum and submit the documentation of its successful completion prior to beginning the practicum experience.

**CAEP 6401. Counseling Children and Adolescents in Schools. (3 Hours)**

Seeks to give students a foundation in the selection, evaluation, and application of empirically supported counseling interventions for children and adolescents. Topics include individual and group counseling techniques as well as specific clinical issues related to school-age children, families, family-school collaboration, and systems.

**CAEP 6402. Promoting Social, Emotional, and Behavioral Success in Schools. (3 Hours)**

Seeks to give students a foundation in the selection, implementation, and evaluation of evidence-based Tier 1 (classwide, universal) and Tier 2 (small group, targeted) interventions. Promotes an understanding of best practices and evidence-based approaches that promote school mental health.

**Prerequisite(s):** CAEP 6401 with a minimum grade of B

**CAEP 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CAEP 6999. Practicum Continuation. (0 Hours)**

Continues clinical requirements. May be repeated five times.

**CAEP 7412. Systematic Inquiry in Behavior Analysis 1. (1 Hour)**

Provides peer and individualized mentorship as students complete a scholarly behavior analytic project. Provides practice in identifying a behavioral problem and research question, developing methods to examine the question, and completing an IRB application.

**Corequisite(s):** CAEP 8412

**CAEP 7413. Systematic Inquiry in Behavior Analysis 2. (1 Hour)**

Continues CAEP 7412. Provides peer and individual mentorship as students complete a scholarly behavior analytic project. Offers students an opportunity to obtain the skills to complete a comprehensive literature review or case study.

**Prerequisite(s):** CAEP 7412 with a minimum grade of B

**Corequisite(s):** CAEP 8413

**CAEP 7701. Doctoral Seminar in Counseling Psychology. (1 Hour)**

Seeks to advance the student's development as a counseling psychologist based on a scientist-practitioner and ecological model and to ensure that the student is informed regarding the historical and current developments of the discipline of counseling psychology. May be repeated up to three times.

**CAEP 7702. Scholarship, Teaching, and Leadership in Applied Psychology. (3 Hours)**

Studies teaching, scholarship, and leadership within a system of higher education. Explores how teaching and scholarship are related to tenure and promotion processes. Considers ethical issues that arise in university settings (e.g., human subject protection, academic integrity). Offers students an opportunity to develop a research agenda and engage in the peer review process as an author and reviewer, as well as practice using various teaching philosophies, course development, and delivery. Contemplates university and professional leadership positions within the field of applied psychology.

**CAEP 7703. Grant Writing in the Health Professions. (3 Hours)**

Introduces the basic components of the grant writing process, from locating available funding opportunities to submitting a competitive grant proposal. Offers students an opportunity to develop a grant proposal for potential submission.

**CAEP 7710. Advanced Clinical Assessment. (3 Hours)**

Covers contemporary cognitive and personality testing as used in a variety of practice settings. Covers such areas as pain management, risk assessment, and learning styles. PhD students only.

**CAEP 7711. Measurement: Advanced Psychometric Principles. (3 Hours)**

Offers students an opportunity to gain an understanding of classical and modern test theory as well as to develop the capability to use these theories to develop tests for their own purposes. Topics include test validity, item statistics useful in test construction, score scales and norms commonly used in educational testing, item bias and test bias, and ideas of fairness and equity in educational and psychological testing. Introduces factor analysis as well as the major extensions and alternatives to classical test theory, generalizability theory, and item response theory (latent trait theory).

**CAEP 7712. Intermediate Statistical Data Analysis Techniques. (3 Hours)**

Emphasizes the use of existing theories and models as a basis for the formation of questions and hypotheses and for designing research to address those questions and hypotheses. Covers the logic of design of research and hypothesis testing, regression, general linear model (GLM), statistical model building and testing, hierarchical regression, and analysis of covariance structures. Emphasizes consideration of power and effects. Requires students to do problems on the computer and/or by hand using data sets assigned in class. Requires prior completion of a course in basic statistics and a course in methods of research design or permission of instructor.

**CAEP 7716. Advanced Research and Data Analyses 2. (3 Hours)**

Investigates techniques and models for exploring research questions and testing hypotheses developed in the first semester. Explores structural and advanced correlational models using linear and nonlinear approaches, multivariate data analysis, psychometric statistical theory and techniques, and qualitative inquiry. Requires considerable hands-on experience with real data sets. Explores qualitative and methodological approaches to ecological analysis of systems and contexts. Requires students to do problems on the computer and/or by hand using data sets assigned in class. Utilizes SPSS and other computer analysis packages including graphic methods of depicting data. Also covers specialized applications (text analysis software, survey design and scoring software, or specialized graphing programs). Students do projects, prepare reports of an analysis from the data set, and turn in a written report in APA format suitable for publication.

**CAEP 7720. Advanced Clinical Interventions. (3 Hours)**

Considers assessment and intervention from an ecological/systems perspective on a case-by-case basis. Uses individual, group, family, organizational, and community modalities. Emphasizes case conceptualization as a framework for treatment planning and evaluation. Emphasis is on impact of social systems and sociocultural factors. Restricted to PhD students with previous work in group and family counseling.

**CAEP 7732. Legal and Ethical Issues in Community and Educational Settings. (3 Hours)**

Designed to provide a systematic orientation to the ethical and professional issues faced by mental health practitioners in their teaching, research, and practice in a seminar setting. Addresses APA ethical guidelines, legal aspects of psychological practice including licensing, confidentiality in practice and research, historical perspective, supervision and training issues, and current topics of professional concern in counseling and school psychology practice. Considers relevant court decisions affecting psychological practice with children, adults, and family.

**CAEP 7741. Advanced Practicum 1. (1,2 Hours)**

Offers students an opportunity to obtain training in clinical settings to develop clinical skills in assessment, consultation, and interventions under supervision. Examines and supports clinical work within various assessment and treatment modalities. Analyzes systems issues within placement sites, which include but are not limited to administrative and supervisory issues, by focusing on critical analysis and provision of a supportive atmosphere. Provides opportunities to document competency through tapes and detailed process notes of sessions, videotape role-playing, critiques, and feedback. Requires practice in the clinical setting a minimum of 20 hours per week. May be repeated once for a total of 2 semester hours.

**CAEP 7742. Advanced Practicum 2. (1,2 Hours)**

Continues CAEP 7741. Provides an opportunity, under supervision in a clinical setting, to develop clinical skills in assessment, consultation, and interventions. Designed to provide support and evaluation of the advanced practicum placement for second-year students. Seeks to examine and support clinical work and examine systems issues within placement sites, which include but are not limited to administrative and supervisory issues. Opportunity to document competency through tapes and detailed process notes of sessions, videotape role-playing, critiques, and feedback. Focuses on critical analysis and provision of a supportive atmosphere to explore treatment and systems issues. Requires practice in the clinical setting a minimum of twenty hours per week. May be repeated once for a total of 2 semester hours.

**Prerequisite(s):** CAEP 7741 with a minimum grade of B

**CAEP 7743. Advanced Practicum 3. (1,2 Hours)**

Continues CAEP 7742. May be taken by students who elect to do additional practicum work to develop better, or deeper, skills or new skill areas. Requires practice in the clinical setting a minimum of twenty hours per week. May be repeated once for a total of 2 semester hours.

**Prerequisite(s):** CAEP 7742 with a minimum grade of B or CAEP 7742 with a minimum grade of S (Graduate) or CAEP 6355 with a minimum grade of B

**CAEP 7744. Advanced Practicum 4. (1,2 Hours)**

Continues CAEP 7743. Requires practice in the clinical setting a minimum of twenty hours per week. May be repeated once for a total of 2 semester hours.

**Prerequisite(s):** CAEP 7743 with a minimum grade of B

**CAEP 7750. Biological Bases of Behavior. (3 Hours)**

Lays the foundations for an understanding of brain-behavior relations, with an emphasis on implications for the clinician. Topics include basic neuroanatomy, the development of the nervous system over the life span, and hormonal and neuropharmacological aspects of behavioral regulation. Reviews perceptual and motor systems, cognition, emotions, and motivational states from the perspective of their biological underpinnings. Underscores the unfolding of these processes within a psychosocial and cultural context.

**CAEP 7755. Cognitive and Affective Bases of Behavior. (3 Hours)**

Provides students with an in-depth treatment of the theories of the cognitive and affective bases of behavior and their applications. Reviews the impact of thinking, emotions, affect, and temperament on behavior in the context of the ecological model. Restricted to PhD students.

**CAEP 7756. Social Psychology in an Organizational and Ecological Context. (3 Hours)**

Conducted as a seminar designed to meet the needs of doctoral students in school and counseling psychology for a course that spans theory and principles of social psychology from early work in the field-in such topics as social pressure, field theory, cognitive dissonance, and attitude formation-to more modern work in expectations, attitudes, and organizational behavior. Surveys basic concerns in social psychology, and considers material related to application in schools, communities, and organizations in which mental health is practiced. For example, in the study of group dynamics, stresses applications to group learning, administrative leadership, and organization theory. Also covers research paradigms, social change, social influence, system consultation, and community issues as they relate to social psychological considerations. Restricted to PhD students.

**CAEP 7758. Doctoral Seminar in Contemporary Theories of Psychotherapy. (3 Hours)**

Offers a critical examination from an ecological/systems perspective of conceptual developmental and clinical elements of contemporary psychotherapy theories. Emphasis is on object relations, social constructionist, and constructivist theories of personality and therapeutic change. Includes selected theoretical and research readings, lectures in student-led discussion. Evaluates critical issues and future directions of contemporary theoretical schools and considers varied approaches to case examples. The different theoretical approaches are examined through the lenses of gender, class, and cultural adequacy. Restricted to PhD students.

**CAEP 7771. Research Team Experience. (1 Hour)**

Offers students an opportunity to participate in various stages of ongoing research leading up to and including the design of their own research projects. Students are given responsibility for conceptualization, design, implementation, analysis, and interpretation of research according to their skills. Encourages students to tie their research to other aspects of their training as appropriate. Becoming a competent researcher requires active experience. A faculty mentor provides direct supervision to the students.

**CAEP 7798. Doctoral Internship. (0.5-2 Hours)**

Required of all doctoral students in counseling/school psychology PhD programs. Requires a minimum of forty hours per week for twelve months or twenty hours per week for twenty-four months in an accredited (or equivalent by permission) mental health training setting. In addition to internship site supervision and training seminars, interns attend, in person or online, a university-based seminar and complete case assignments. May be repeated up to four times, not to exceed 3 credits.

**CAEP 7799. Doctoral Internship 2. (2 Hours)**

Continues CAEP 7798. Restricted to PhD students.

**CAEP 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CAEP 7976. Directed Study. (1-4 Hours)**

Allows students to pursue topics of individual interest beyond the scope of formal course work under the direction of faculty. May be repeated without limit.

**CAEP 8401. Practicum in Counseling Psychology. (3 Hours)**

Includes forty hours of client contact plus supervision. Focuses on developing individual and group skills within mental health and human service agencies. May be repeated once.

**Prerequisite(s):** CAEP 6399 with a minimum grade of S

**CAEP 8412. Experiential Learning in Skill Acquisition. (2 Hours)**

Offers students an opportunity to obtain practical experience developing, implementing, and evaluating skill acquisition programs. Students work in a clinical setting, including accrual of supervised fieldwork hours required to sit for the Board-Certified Behavior Analyst ® examination.

**Prerequisite(s):** CAEP 6341 with a minimum grade of B

**Corequisite(s):** CAEP 7412

**CAEP 8413. Experiential Learning in Behavioral Supervision. (2 Hours)**

Provides students with the opportunity to practice methods of staff training and supervision. Offers students supervision for work in a clinical setting, including accrual of supervised fieldwork hours required to sit for the Board-Certified Behavior Analyst ® examination.

**Prerequisite(s):** CAEP 6342 with a minimum grade of B

**Corequisite(s):** CAEP 7413

**CAEP 8415. Practicum in School Psychology 1. (2 Hours)**

Offers supervised school-based field experience coupled with seminar class. Requires passing score on the communication and literacy tests of the Massachusetts Tests for Educator Licensure (MTEL).

**CAEP 8416. Practicum in School Psychology 2. (2 Hours)**

Offers supervised school-based field experience coupled with seminar class.

**Prerequisite(s):** CAEP 8415 with a minimum grade of S

**CAEP 8417. Intensive Practicum in Applied Behavior Analysis 1. (2 Hours)**

Offers students supervised experience that is required in order to sit for the BACB exam. Focuses on offering students an opportunity to acquire new behavior analytic skills related to the BACB Task List. Asks students to demonstrate the necessary skills to be a competent behavior analyst in applied settings. Covers preference assessments, task analysis and other skill acquisition programs, and other teaching strategies.

**CAEP 8418. Intensive Practicum in Applied Behavior Analysis 2. (2 Hours)**

Continues the work of CAEP 8417 with the primary focus on offering students an opportunity to acquire new behavior analytic skills related to the BACB Task List. Covers functional assessment, behavior reduction programs, conditioned reinforcement, data analysis, and clinical decision making.

**Prerequisite(s):** CAEP 8417 with a minimum grade of C-

**CAEP 8419. Intensive Practicum in Applied Behavior Analysis 3. (2 Hours)**

Continues the work of CAEP 8417 and CAEP 8418 with the primary focus on offering students an opportunity to acquire new behavior analytic skills related to the BACB Task List. Covers behavioral approaches to curriculum-based assessment, discrimination training, shaping, chaining, and pedagogies of teaching.

**CAEP 8421. Intensive Practicum in Applied Behavior Analysis 4. (2 Hours)**

Continues the work of CAEP 8417, CAEP 8418, and CAEP 8420 with the primary focus on offering students an opportunity to acquire new behavior analytic skills related to the BACB Task List. Covers behavioral approaches to skills assessment, training, supervision, and consultation.

**CAEP 8501. Internship in School Psychology 1. (3 Hours)**

Offers supervised school-based field experience coupled with seminar class.

**CAEP 8502. Internship in School Psychology 2. (1-2 Hours)**

Offers supervised school-based field experience coupled with seminar class. May be repeated once.

**CAEP 8510. Internship in Counseling Psychology 1. (3 Hours)**

Provides twenty hours per week in a field setting and a two-hour seminar on campus. In addition to providing supervising seminar, addresses practices, procedures, ethics, and policies in professional practice.

**CAEP 8511. Internship in Counseling Psychology 2. (3 Hours)**

Provides twenty hours per week in a field setting and a two-hour seminar on campus. In addition to providing supervising seminar, addresses practices, procedures, ethics, and policies in professional practice.

**CAEP 8553. Advanced Counseling Practicum. (1,2 Hours)**

Offers an elective course for doctoral students in the counseling psychology doctoral program who are completing additional years of supervised practical experience (minimum of 20 hours per week for 600 hours) as part of the training for the PhD degree and in clinical preparation for the APPIC/APA internship match process. Offers students training in clinical settings. Includes a seminar to offer students an opportunity to develop clinical skills in assessment, consultation, and interventions under supervision. Provides support and evaluation of the advanced fieldwork placement in which doctoral students are involved throughout the year. Led by a faculty supervisor who is the official liaison between Northeastern University and the advanced fieldwork sites. May be repeated up to five times for up to 6 total credits.

**Prerequisite(s):** CAEP 7744 with a minimum grade of C-

**CAEP 8984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated up to four times.

**CAEP 8986. Research. (0 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**CAEP 9000. Comprehensive Exam. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**CAEP 9990. Dissertation Term 1. (0 Hours)**

Offers dissertation supervision by individual members of the department. Restricted to PhD students.

**Prerequisite(s):** CAEP 9000 with a minimum grade of S

**CAEP 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** CAEP 9990 with a minimum grade of S

**CAEP 9996. Dissertation Continuation. (0 Hours)**

Supports the continued development of the dissertation.

**Prerequisite(s):** CAEP 9991 with a minimum grade of S or Dissertation Check with a score of REQ

**Creative Technologies (CRTE)**

**CRTE 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CRTE 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CRTE 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CRTE 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CRTE 5010. Understanding Creative Technologies. (4 Hours)**

Offers students an opportunity to engage with the communicative and ethical dimensions of new technology through a combination of empirical analysis and problem solving. Organized into four units that collectively present an interdisciplinary approach to media and technology in the 21st century. Begins with a technology-focused unit that emphasizes how social and cultural contexts shape how machines function and how people interact with them. Continues with units concerning digital media and design and audience that introduce the creation of media content through a critical lens. Concludes with a unit on ethics that asks students to reflect on the ethical dimensions of the decisions and problem solving highlighted in previous units.

**CRTE 5030. Developing Creative Technologies. (4 Hours)**

Explores tools, processes, and technologies to develop human-centered prototype experiences with creative technologies. Offers students an opportunity to learn, use, experiment with, and test creative technologies using prototype scopes ranging from rapid and paper prototypes to mid- and high-fidelity prototypes. Also offers choice of technology based on student interest. Students share and learn through critique and user testing from interdisciplinary feedback to improve their prototype projects.

**CRTE 6500. Creative Technologies Studio. (4 Hours)**

Focuses on the design of experiences and artifacts using creative technologies starting with concepts and culminating with a usable project. Students utilize multiple ideation methods to develop their project ideas. Once ideas have been cultivated, students work individually or as part of a small group to bring their project to fruition. Students work in critical groups to strengthen project ideas, prototype them using current hardware and software to collect meaningful feedback, and iterate to improve the project. Designed to illustrate the need for rapid innovation, resiliency, and gracefulness in the face of frequent failure situations.

**CRTE 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CRTE 7500. Creative Technologies Project. (4 Hours)**

Offers students an opportunity to create a culminating project that builds upon the studio course project and aligns with their chosen concentration and professional aspirations. Students work individually or as part of a small group to outline a proposal to guide the planning and design of the project that will serve as the cornerstone of their portfolio. Weekly work results in a formal prototype, written report, and final presentation that discusses and reflects on the design process at the crossroads of methodological, systematic iteration and creative exploration.

**Prerequisite(s):** CRTE 6500 with a minimum grade of C

**Creative Writing (CRWT)****CRWT 1170. Creative Writing Foundations. (4 Hours)**

Introduces the foundations of creative writing through engagement with various forms of fiction, creative nonfiction, and poetry. Designed to train students to read as writers, identify and experiment with craft elements, and produce their own writing in multiple genres. Historicizes the contemporary field in relationship to literary tradition and theory. Introduces the workshop model with a focus on written feedback, discussion, and self-reflection.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**CRWT 1801. Writing Creatively in the Age of Artificial Intelligence. (4 Hours)**

Engages students in the practice of creative writing with state-of-the-art writing tools, collaborative platforms, and frontier technologies such as artificial intelligence. Examines a wide range of works of literature, both those written with machines and those written about machines. Focuses on student writing in diverse genres. Examines how machine-produced writing is reshaping understandings of creativity, authorship, and copyright.

**Attribute(s):** NUpath Creative Express/Innov

**CRWT 1850. Creative Writing, Identity, and Representation. (4 Hours)**

Introduces students to the craft of writing personal narratives in diverse genres. Analyzes narratives that address themes of personal history, identity, and memory to identify storytelling techniques and representational strategies. Deploys these texts as models as students produce original pieces of creative writing that express their own complex identities. Investigates how personal narratives are published, marketed, and received.

**Prerequisite(s):** ENGL 1102 (may be taken concurrently) with a minimum grade of C or ENGL 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**CRWT 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**CRWT 2200. Creative Writing for Social Impact. (4 Hours)**

Examines and practices the craft of creative writing as a tool to reflect social realities, destabilize assumptions, and effect social change. Introduces and builds upon texts that challenge convention; amplify marginalized voices; and address themes of equity, advocacy, and justice. Offers students an opportunity to craft original pieces using traditional, hybrid, and experimental forms.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**CRWT 2350. Creative Writing and the Environmental Imagination. (4 Hours)**

Offers the developing writer instruction in creative writing focused on climate and the environment. Analyzes literary models in multiple genres, situating examples within theoretical discussions of utopian and dystopian narratives, ethical dilemmas, and the relationship between imaginary and real-world futures. Offers students the opportunity to produce and workshop their own creative writing drafts along with a sustained project in one creative writing genre about an environmental issue of their choice.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Ethical Reasoning

**CRWT 2400. Writing Popular Fiction. (4 Hours)**

Offers instruction in the craft and technique of writing genres of fiction that have broad popular and commercial appeal including mystery, suspense, thriller, science fiction, horror, paranormal, historical, romance, and writing for middle grade and young adult audiences. Discusses genre histories, trends, conventions, and techniques, and practices outlining and writing fiction in multiple genres and subgenres. Examines issues in the publishing industry and opportunities for writers interested in publishing their own genre fiction in today's market.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**CRWT 2450. Sports Stories: Creative Writing and the Athletic Experience. (4 Hours)**

Explores the intersection of sports and storytelling through the lens of creative writing. Analyzes literary technique in classic and contemporary examples of sports literature emphasizing themes of competition, teamwork, challenge, defeat, and triumph. Practices techniques and craft devices such as narrative, character, and voice as students produce their own narratives set in athletic worlds. Also explores the complex representational politics of sport and engages students in the crafting of literary work that thoughtfully addresses these issues. Utilizes the workshop model to encourage experimentation and build skills in critique and revision.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**CRWT 2700. Creative Writing. (4 Hours)**

Gives the developing writer an opportunity to practice writing various forms of both poetry and prose. Features in-class discussion of student work.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**CRWT 2973. Topics in Creative Writing. (4 Hours)**

Offers instruction on a selected topic related to creative writing. May be repeated twice for a maximum of 12 semester hours.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**CRWT 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**CRWT 3376. Creative Nonfiction. (4 Hours)**

Explores how writers apply narrative strategies and techniques to factual material. Offers students an opportunity to read and write a variety of nonfiction forms (e.g., narrative essays and narrative journalism, travel and science writing, memoir, editorials, protest and political essays), as well as cross-genre and hybrid forms (e.g., nonfiction prose mixed with poetry, audio and graphic nonfiction). The topics for narrative nonfiction writing apply to a wide array of disciplines, including the humanities, the sciences, and journalism.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Writing Intensive

**CRWT 3377. Poetry Workshop. (4 Hours)**

Offers an advanced workshop in writing and reading original poetry. Offers students an opportunity to experiment in established poetic forms. Features in-class discussion of student work.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**CRWT 3378. Fiction Workshop. (4 Hours)**

Offers an advanced workshop in writing and reading original fiction. Features in-class discussion of student work.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**CRWT 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**CRWT 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**CRWT 6101. Algorithmic Literatures. (4 Hours)**

Offers the developing writer an opportunity to write literature with a special emphasis on how technology might assist in this process. Explores the conventions of literary forms such as narrative, point of view, character, and setting through a range of theoretical texts that use post-structuralist or machine-learning approaches. Introduces a diverse range of example works of literature. Requires a series of creative assignments in multiple genres.

**CRWT 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

## Criminal Justice (CRIM)

### **CRIM 1000. Criminal Justice at Northeastern. (1 Hour)**

Designed to help students adjust to college life and become fully acquainted with the resources and services offered by the University. Covers various campus services, studies how to access various library resources, and focuses on study skills and time management. Also explores various careers for which the criminal justice major can prepare students.

### **CRIM 1100. Introduction to Criminal Justice. (4 Hours)**

Surveys the contemporary criminal justice system in the United States. Examines the phases of the criminal justice system beginning with the detection of crimes by the police; the handling of the case through the courts; and, finally, disposition and sentencing. Analyzes issues and characteristics of each of the phases of the criminal justice system (police, courts, and corrections) and identifies its key actors (for example, police, judges, prosecutors, correctional officers). Traces the role of systemic racism and intersecting dimensions of oppression in the historical development of and current policies and practices in the criminal justice system. Also introduces students to the U.S. juvenile justice system.

**Attribute(s):** NUpath Societies/Institutions

### **CRIM 1110. Criminal Due Process. (4 Hours)**

Focuses on a historical evaluation of the Fourteenth Amendment of the U.S. Constitution and its use in making rights prescribed under the Bill of Rights applicable to the individual states. Examines constitutional requirements in the administration of criminal justice with a particular emphasis on the Fourth, Fifth, and Sixth Amendment requirements and their implications for police practices in the areas of arrests, searches and seizures, right to counsel, and eyewitness identification. Through discussions of recent criminal cases, exposes students to the role that bias plays in wrongful convictions. Expects students to be familiar with basic concepts and legal language as well as the courts' changing interpretations of the law. Briefing of cases is required.

**Attribute(s):** NUpath Societies/Institutions

### **CRIM 1120. Criminology. (4 Hours)**

Describes the nature and extent of crime, explains its causes, and examines society's responses to it. Defines the field of criminology by discussing the different types of crime and discusses different theories of crime causation. Studies the connections between systemic racism, inequalities, and crime and the role of bias in the development of the field and criminological theories. To establish the extent of crime in society, addresses measurement issues in the field of criminology.

**Attribute(s):** NUpath Societies/Institutions

### **CRIM 1300. The Death Penalty. (4 Hours)**

Reviews the history of the death penalty in the United States from colonial times through the present. Among Western democracies, the United States stands alone in its continued use of capital punishment as a sanction. Examines the contemporary death penalty and the many controversies surrounding its continued use (focusing on U.S. Supreme Court decisions around the constitutionality of the death penalty). Discusses historical and contemporary controversies around the administration of the death penalty including potential innocence, special populations, methods of execution, race and gender biases, costs, deterrence, and international relations.

### **CRIM 1400. Human Trafficking. (4 Hours)**

Offers an overview of human trafficking in its various forms. Emphasizes understanding the experiences and needs of trafficking victims and the methods of operations of traffickers and their networks across various cultural contexts. The trafficking of persons for sex or labor through force, fraud, or coercion has become an increasingly serious problem in modern society. Federal, state, and local criminal justice authorities have been tasked with the responsibility of identifying and rescuing trafficking victims and prosecuting their perpetrators. Offers students an opportunity to critically evaluate the social and cultural practices that give rise to and support human trafficking in the United States and around the globe.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

### **CRIM 1500. Corruption, Integrity, and Accountability. (4 Hours)**

Traces the history, nature, and current effects of corruption using concrete cases and illustrations. Covers international and national laws and standards against corruption (with special emphasis on the U.N. Convention against Corruption and the Foreign Corrupt Practices Act). Discusses efforts to measure corruption, governance, and anticorruption efforts. Focuses on the role of stakeholders from private sector to government, civil society, and individual actors. Corruption affects every aspect of our life and its quality. From bribery and illicit enrichment to obstruction of justice, from abuse of power to clientelism and favoritism, corrupt acts touch global, national, and local communities. Illustrates how fundamental are the values and practice of integrity, responsibility, and accountability.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**CRIM 1700. Crime, Media, and Politics. (4 Hours)**

Discusses and critiques contemporary portrayals of crime and justice in the arenas of political debates and campaigns; news reports; and films, television shows, and music. Covers current events as they occur in these arenas. To set up these discussions, students have an opportunity to develop critical tool kits for assessing these images of crime and justice by reading and discussing theories, research, and critiques. Additionally, students are expected to read and discuss historical portrayals of crime and justice with the goal of identifying both parallels and differences between these and current events.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**CRIM 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CRIM 2310. Courts: The Third Branch of Government. (4 Hours)**

Studies the third branch of government—the judiciary: how courts work, how they are structured, what they do, and how they do it. Examines the theoretical underpinnings of our three-branch system of government; explores the U.S. and Massachusetts constitutions; and discusses the concepts of separation of powers and of judicial review. Students visit a number of state and federal courts to observe and interact with court leaders. Explores the interplay of the judiciary with the legislative and executive branches, as well as with external entities such as business and the media. Examines the role of the courts as a critically important component of a democratic society.

**Attribute(s):** NUpath Integration Experience

**CRIM 2320. Youth Crime and Justice. (4 Hours)**

Introduces students to the history, structure, processes, and philosophies of juvenile justice systems in the United States. Responses to juvenile offenders—ranging from prevention and diversion to institutional corrections and aftercare—are explored in the context of youth policy generally. Focuses on contemporary issues and controversies (system fragmentation, changing conceptions of juvenile offenders, lack of a coherent justice system rationale, racial and gender bias in processing and confinement, and proposals to abolish the juvenile court).

**CRIM 2330. Punishment in the Age of Mass Incarceration. (4 Hours)**

Examines the concept of punishment and its form, function(s), and enforcement throughout history, with an emphasis on current sentencing policies and procedures and their impact on the corrections system and correctional overcrowding. Explores the operation, structure, clientele, and issues confronting the institutions, agencies, and programs encompassing the corrections system including jails, prisons, and community-based corrections.

**CRIM 2340. Corporate Security: Securing the Private Sector. (4 Hours)**

Examines the history and evolution of security from a focus on crime prevention to one of loss prevention for business, industry, institutions, and government. Emphasizes the need for analytical, interpersonal, and communications skills in developing cost-effective programs for the protection of assets, personnel, and third parties. Discusses the security/government relationship.

**CRIM 2350. Policing a Democratic Society. (4 Hours)**

Traces the history, evolution, and organization of the police in the United States. Examines the role of police in society, structure and culture of police organizations, function and activities of the police, and police deviance and accountability. The course objectives are to acquaint students with prior research on the police, examine critically the police as a component of the criminal justice system, explore the complex nature of the profession, and assist those who are considering a policing career to understand the realities of the job.

**CRIM 2370. Restorative Justice: Transforming the System. (4 Hours)**

Explores the roots of restorative justice and locates contemporary examples of its application in various settings in the United States and the world. Examines its utility in addressing the mass incarceration crisis and the current penal system and mode of punishment in the United States. Students practice and apply critical race and systems theories to use a systems lens to examine the impact of racism, sexism, gender discrimination, and other systems of oppression on behavior and the justice system.

**Attribute(s):** NUpath Integration Experience

**CRIM 2380. Black Families and Incarceration. (4 Hours)**

Focuses on how the Black family functions, both interpersonally and as a social unit within a carceral state. Introduces the diverse institutional, cultural, and historical issues relating to past and present circumstances from the effects of slavery and colonization on the Black family structure. Explores policies and practices within carceral institutions dealing with childhood, motherhood, and fatherhood. Assesses the social and psychological harms of incarceration on Black children and their families.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity

**CRIM 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CRIM 2991. Research Practicum. (2-4 Hours)**

Involves students in collaborative research under the supervision of a faculty member. Offers students an opportunity to learn basic research methods in the discipline. Requires permission of instructor. May be repeated once for up to 4 total credits.

**CRIM 3000. Co-op Integration Seminar 2. (1 Hour)**

Continues CRIM 2000. Allows students to reflect on what they learned during their first co-op, and use their journal entries as the basis from which to examine real-life issues of ethics, values, and diversity as they experienced them in the workplace.

**Prerequisite(s):** CRIM 2000 with a minimum grade of D- or EESH 2000 with a minimum grade of D-

**CRIM 3010. Criminal Violence. (4 Hours)**

Surveys the trends, nature, patterns, and causes of criminal violence. Blending sociological and psychological perspectives on violent criminal behavior, focuses on serial and mass murder, sexual predators, youth and school violence, violence among intimates and family members, as well as the impact of media and entertainment violence. The effectiveness of various criminal justice responses are also examined including intervention strategies, police tactics, gun control, incarceration, and capital punishment.

**CRIM 3030. Global Criminology. (4 Hours)**

Seeks to strengthen an understanding of crime and its causes from a comparative, cross-national standpoint. In doing so, it places extant definitions of crime and deviance in a cultural context. Explores existing methods of studying crime on a global scale; offers an overview of various types of criminal and deviant behavior that occur in isolated group contexts as well as those crimes that transcend country boundaries. Examines various strategies designed to address these acts of crime on a national as well as transnational level.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**CRIM 3040. Psychology of Crime. (4 Hours)**

Explores the inner lives of offenders including cognitive, emotional, perceptual, and physiological phenomena. Examines the ecological context of crime, individual and social risk factors for psychological attributes related to offending, how these attributes develop, how they interact with the environment to produce crime, and, most importantly, how knowledge of the psychology of crime can assist in efforts to prevent delinquency or to help offenders desist.

**CRIM 3050. Organized Crime. (4 Hours)**

Examines the myths and realities surrounding organized crime. Offers an overview of the nature and extent of organized crime, the factors that contribute to it, as well as the origins and opportunities/motives for criminal enterprises. Discusses the impact of organized crime on U.S. society, both in terms of economy and politics. Also examines the interconnections between organized criminals and legitimate organizations as well as analyzes legislative and policy responses.

**CRIM 3060. Political Crime and Terrorism. (4 Hours)**

Provides students an understanding of what political crime and terrorism is, the nature and extent of the problem historically and currently, as well as prevention efforts designed to combat political crime and terrorism. Students are exposed to several sources of information on political crime and terrorism including the news media, scholarly sources, and video accounts.

**CRIM 3070. Corporate and White-Collar Crime. (4 Hours)**

Introduces students to a variety of topics and issues in the areas of white-collar and corporate crime. Examines corporate and white-collar offending through the criminal justice and regulatory justice systems, beginning with detection and prosecution through adjudication and sentencing. A variety of special topics are also covered such as definitional issues, the nature and extent of white-collar crimes, measurement, crime types, case studies, and the etiology of offending.

**CRIM 3100. Criminal Law. (4 Hours)**

Discusses the definition of common crimes and criminal responsibility. Addresses moral, philosophical, constitutional, and public policy considerations in the use of criminal sanctions to regulate conduct. Requires the knowledge of particular criminal law concepts and the ability to identify them in complex fact patterns and discuss their implications and ramifications. Also requires the application of legal principles to fact situations in a logical way. Case briefing is required.

**CRIM 3110. Gender, Crime, and Justice. (4 Hours)**

Examines the topics of femininities and masculinities and their influence on participants in the criminal justice system. Also explores topics such as gender and criminological theory; the notion of gender and offending; women and men as victims of violence; and women and men as professionals within the criminal justice system.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**CRIM 3120. Race, Crime, and Justice. (4 Hours)**

Provides students with an overview of the role and treatment of racial/ethnic minorities in the criminal justice system. Covers historical and theoretical frameworks for understanding the relationship between race, crime, and criminal justice. In so doing, students become familiar with trends and patterns in criminal offending by racial/ethnic minorities, as well as system response to such behavior.

**Attribute(s):** NUpath Difference/Diversity

**CRIM 3540. Substance Use and Social Justice. (4 Hours)**

Analyzes the intersections of substance use with forms of oppression from a social justice harm reduction lens. Presents the complex interactions of biological, psychological, and social determinants of health as they relate to substance use and misuse. Explores the nature, etiology, and treatment of substance use disorders and how they relate to the health and human services field. Offers students an opportunity to obtain the requisite foundation knowledge of, and skills in, evidence-informed substance use prevention, education, and treatment with individuals, groups, families, organizations, and communities.

**CRIM 3600. Criminal Justice Research Methods. (4 Hours)**

Introduces the basic concepts involved in conducting research in the areas of the criminal justice system and criminology. Through lectures, group discussions, and readings, familiarizes students with the scientific methods that are necessary for systematic analysis of crime trends, offender behavior, program effectiveness, and public attitudes about crime and justice. Critiques the historical role of racism and other biases in the development and implementation of research questions and methods. Offers students an opportunity to become capable of developing a research question, investigating and critiquing how it has been researched, developing a research design, and administering its implementation.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Writing Intensive

**CRIM 3700. Analyzing and Using Data on Crime and Justice. (4 Hours)**

Offers a foundation in different statistical techniques that may be utilized to answer research questions in the social sciences. Examines a range of computational social science techniques across data platforms to address crime and criminal justice system problems. Emphasizes existing databases that may inform questions about crime and criminal justice. Also introduces students to different ways to display or visualize quantitative data. Offers students an opportunity to learn how to produce and consume quantitative information.

**Attribute(s):** NUpath Analyzing/Using Data

**CRIM 3900. Topics in Criminal Justice and Criminology. (1-4 Hours)**

Focuses on topics related to criminal justice to be selected by instructor. May be repeated without limit.

**CRIM 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CRIM 4000. Co-op Integration Seminar 3. (1 Hour)**

Continues CRIM 3000 and builds upon what students learned in their first and second co-ops. Focuses on experiences and research journals from the second co-op. Students discuss their research activities and findings, engage in critical thinking about the nature of organizations, and reflect on their possible career paths.

**Prerequisite(s):** CRIM 3000 with a minimum grade of D-

**CRIM 4040. Crime Prevention. (4 Hours)**

Offers an overview of issues related to crime prevention, both from criminological and criminal justice points of view. Examines crime prevention programs that encompass both the individual and community levels, as well as the integration of such levels. Offers students an opportunity to learn current theories of and leading research on the main approaches to preventing crime, including developmental, situational, and community prevention. Focuses on assessing effectiveness of prevention programs and policies.

**Attribute(s):** NUpath Writing Intensive

**CRIM 4120. Courts and Sentencing. (4 Hours)**

Examines the role of criminal courts in the United States, the structure and organization of the court system, and the flow of cases from arrest to conviction. Focuses on the key actors in the courtroom—prosecutors, defense attorneys, judges, and court clerks—and the decision-making processes in charging a person with a crime, setting bail, pleading guilty, going to trial, and sentencing. Addresses prospects for reforming courts.

**CRIM 4710. Law and Psychology. (4 Hours)**

Examines a broad array of topics, from criminal profiling to the nature of justice and its relationship to social control. Focuses on five major questions: what forensic psychologists do; how psychologists and lawyers look at the world; how the criminal justice system (police, courts, and corrections) and other institutions involved in social control use psychologists; what psychologists think about the criminal justice system and other institutions of social control; and how psychological (and other behavioral science) research can be used to help prevent crime. Because psychologists and lawyers see the world very differently, the course is designed to help facilitate communication and understanding among present and future practitioners in each field, as well as in criminal justice and delinquency prevention generally.

**CRIM 4949. Senior Capstone Seminar. (4 Hours)**

Offers students an opportunity to engage in a semester-long capstone project in which they identify a crime or justice system problem to research and propose a policy solution. Students draw on a variety of knowledge, tools, and experiences from their time at Northeastern: understandings of and experiences with justice system institutions, knowledge of the causes and consequences of crime and the laws intended to protect the accused, and expertise in the methods used and problems encountered in addressing crime and justice issues.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CRIM 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated without limit.

**CRIM 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** CRIM 4970 with a minimum grade of D-

**CRIM 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CRIM 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**CRIM 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**CRIM 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**CRIM 5201. Global Criminology. (4 Hours)**

Examines how the processes of globalization influence crime and criminal justice around the globe. Analyzes globalization and recent developments in global crime, including global trends in policing and security. Explores the global applicability of dominant criminological theories and transferability of crime control policies. Offers students an opportunity to develop an understanding of international criminal justice, particularly as it pertains to war crimes, crimes against humanity, and the global protection of human rights.

**Attribute(s):** NUpath Interpreting Culture

**CRIM 5203. Security in the 21st Century. (4 Hours)**

Examines societal security concerns by drawing upon current work in the social sciences, humanities, and physical sciences, as well as research and policy initiatives from public, private, nongovernmental, and nonprofit organizations. Offers students an opportunity to review extensive work on the interconnected nature of different types of risk and on the development of integrated strategies to address threats to security and sustainable growth. Considers the continuing evolution of global social justice, values, and institutions that can support comprehensive security and sustainable growth strategies in the 21st century.

**CRIM 5250. Victimology. (4 Hours)**

Involves a scientific study of crime victims and public policy responses to them. Focuses on the nature and extent of criminal victimization, the dynamics of victim-offender relationships (e.g., incest and domestic violence), theories of victimization, a historical analysis of the victim's role in the criminal justice process, the restorative justice model, and the contemporary victim rights and victim services movement.

**CRIM 5264. Immigration and Crime. (4 Hours)**

Focuses on crime and deviance (or lack thereof) among immigrant populations in the United States. Offers students an opportunity to develop an understanding of the historical relationship between patterns of immigration and patterns of crime, to examine the nature and extent of contemporary immigrant crime and victimization, and to assess the social and health consequences associated with crime among immigrant populations and within immigrant communities.

**CRIM 5270. Crime Mapping. (4 Hours)**

Offers students an opportunity to obtain an understanding of how crime mapping is used by law enforcement agencies. Designed as a practical and hands-on introduction to various crime mapping techniques. Employs a holistic approach to learning how to create and interpret maps, which seeks to provide a much deeper understanding of crime mapping and leave students with a solid foundation of skills that are transferable and scalable.

**CRIM 5600. Illicit Flows and Criminal Networks. (4 Hours)**

Reviews in-depth the extent, nature, victimization, causes, responses, and control of the problem of illegal trade in a variety of products. Focuses on medical supply chains and a wide variety of consumer goods. Examines the types of crimes committed, theoretical frameworks that can be used for the study of these types of misconduct, and the types of victimization associated with illicit flows and criminal networks. Investigates the social organization of illegal markets and networks. Studies techniques and technologies used for authentication, security, prevention, detection, investigation, and sanctioning of offenses, as well as disruption and mitigation strategies governance challenges.

**CRIM 5601. Financial Crimes. (4 Hours)**

Offers an in-depth review of the extent, nature, causes, and control of the problem of financial crimes. Through readings, group discussion, and research assignments, familiarizes students with financial crimes such as terrorism financing, money laundering, fraud, corruption, and banking scandals. Examines the nature and extent of offenses committed by corporations, professionals, and public officials in the course of their occupations. Investigates the social, economic, and physical costs of such misconduct. Proposes challenges, techniques, and approaches to effective prevention, detection, investigation, regulation, and sanctioning of financial crimes.

**CRIM 5602. Crime, Place, and Community. (4 Hours)**

Reviews in-depth the relationship between the characteristics of and social processes in communities and criminal behavior within those communities. Explores the nature of communities and crime through research-policy collaborations. Examines the complementary roles of "communities" and the "places" therein (i.e., individual properties) in shaping crime patterns. Examines how public safety agencies do their job through conversations with local practitioners. Investigates the design and execution of a research study on how community organizations and public agencies interface in addressing "problem properties".

**CRIM 5900. Topics in Criminal Justice and Criminology. (4 Hours)**

Offers an intensive study of a topic related to criminal justice selected by the instructor. May be repeated up to four times.

**CRIM 6200. Criminology. (4 Hours)**

Offers an overview of the current understanding of the causes of crime from an interdisciplinary perspective. Focuses on the historical and contemporary theories of crime and causation. Examines the connections between systemic racism, inequalities, and crime and the role of bias in the development of the field and criminological theories. Emphasizes integrating criminological theory and research, assessing the implications of this knowledge base for policies relating to crime control and prevention. Presents and discusses the most current data regarding the nature and extent of crime in the United States.

**CRIM 6202. The Criminal Justice Process. (4 Hours)**

Offers an overview of the criminal justice process and the important issues confronting the administration of justice, grounding these challenges in empirical research. Focuses on theories that explain the functioning of the justice system and predict its outcomes. Identifies changes in institutional responses to crime and justice issues over time and across cultural contexts. Traces the role of systemic racism and intersecting dimensions of oppression in the historical development of and current policies and practices in the criminal justice system.

**CRIM 6262. Evidence-Based Crime Policy. (4 Hours)**

Introduces students to the evidence-based paradigm in crime policy. Presents the theory and methods of the evidence-based paradigm, which places systematic research at the center of the policymaking process. Offers students an opportunity to further develop skills in critically assessing leading research findings and policy initiatives in the field of criminology and criminal justice.

**CRIM 6504. Policing in U.S. Communities. (4 Hours)**

Studies the historical and contemporary issues regarding the purpose and function of police in U.S. communities. Focuses on understanding variation in crime-control strategies across ecological settings, which complicates police leaders' efforts to reach balance between appropriately responding to citizen calls for service and proactive policing. Highlights effective policing efforts, which routinely involve bringing officers and community residents together in the hope of solving problems. Critically assesses the role of systemic racism and contemporary police practices that impact police-community relationships.

**CRIM 6600. Justice, Technology, and AI. (4 Hours)**

Examines the rapidly evolving role of technology and artificial intelligence in public policy and the criminal legal system. Introduces the legal processes implicated by AI, describes the constitutional criminal procedure rules at stake, and deepens understanding of these technologies. Studies the fundamentals of how these new technologies work and analyzes their development, implementation, and effects through a social science lens.

**CRIM 6601. American Violence and Victimization. (4 Hours)**

Presents an in-depth examination of violence and victimization in the United States. Discusses various forms of violence (structural, institutional, and interpersonal) while taking into consideration the experiences of victims and survivors. Explores the historical and cultural roots of violence. Offers students an opportunity to gain a deeper understanding of the causes and consequences of violence in the U.S., which is designed to provide a foundation to analyze the most appropriate and effective approaches to creating safer communities.

**CRIM 6605. Youth Networks and Crime. (4 Hours)**

Presents the ways that group processes, peers, and patterns of social relationships can help explain young people's experiences with delinquency and criminal justice systems. Adopts a social network perspective to deepen the understanding of adolescent crime and gangs and addresses several theories about youth crime and delinquency. Covers key methodological techniques from social network analysis that offer students an opportunity to obtain the tools that can be applied to study various groups, processes, and institutions of interest to juvenile justice scholars (e.g., gangs, schools, neighborhoods).

**CRIM 6701. Fundamentals of Crime Analysis and Knowledge Dissemination in ArcGIS Pro. (1 Hour)**

Introduces the basic functionality of ArcGIS Pro, the industry standard in spatial analysis software. Explores the various ribbon panes and data portals that comprise the ArcGIS Pro interface, the theoretical and practical foundations of the crime analysis profession, and maps and other crime analysis products. Examines how to prepare ArcGIS Pro outputs for dissemination to wider audiences.

**CRIM 6702. Geoprocessing and Data Integration in ArcGIS Pro. (1 Hour)**

Addresses common geoprocessing and data integration approaches in ArcGIS Pro, the industry standard in spatial analysis software. Explores how to search for geoprocessing tools in the ArcGIS Pro toolbox, run common geoprocessing functions, create and edit GIS data layers, maximize the analytical value of feature attribute tables, and conduct queries of GIS data layers.

**CRIM 6703. Hot Spot Tracking and Temporal Analysis in ArcGIS Pro. (1 Hour)**

Addresses hot spot tracking and temporal analysis techniques in ArcGIS Pro, the industry standard in spatial analysis software. Explores how to create and edit raster data, calculate incident counts within vector features, conduct temporal forecasting, and map sequential phases of events.

**CRIM 6704. Spatial Statistics and Automation in ArcGIS Pro. (1 Hour)**

Addresses spatial statistics and analysis automation in ArcGIS Pro, the industry standard in spatial analysis software. Explores how to identify statistically significant incident clusters, calculate patterns of feature attribute values, conduct regression analysis, create task processes, and create models to automate geoprocessing workflows.

**CRIM 6801. Fundamentals of Crime Analysis and Mapping. (4 Hours)**

Introduces students to the field of crime analysis and conducting crime mapping in the ArcGIS Pro software suite. Offers lectures on theoretical and practical aspects of the crime analysis profession and hands-on exercises using real-world crime and public safety data. Students develop the skills necessary to critically assess crime patterns and potential crime prevention interventions, create crime maps and other crime analysis products, analyze and interpret geospatial and temporal crime data, create and edit GIS data layers, edit and join tables, and query and export GIS data.

**CRIM 6802. Data Management for Social Scientists. (4 Hours)**

Introduces data collection, cleaning, preparation, and documentation. Offers students an opportunity to apply hands-on exercises to data and transform them from their raw state to an analysis-ready dataset. Emphasizes the principles and practice of data management and the development of intuition and logic skills related to the preparation and analysis of data. Introduces readily available and open-source software packages including Microsoft Excel, Python, and R.

**CRIM 6900. Topics in Criminal Justice and Criminology. (4 Hours)**

Offers intensive study of a topic related to criminal justice, selected by the instructor. May be repeated up to four times.

**CRIM 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**CRIM 6955. Co-op Work Experience Abroad - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**CRIM 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CRIM 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated twice.

**CRIM 6965. Co-op Work Experience Abroad. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**CRIM 6966. Practicum. (1-4 Hours)**

Provides eligible students with an opportunity for practical experience. May be repeated without limit.

**CRIM 6984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**CRIM 7001. PhD Pro-Seminar in Criminology and Justice Policy 1. (0 Hours)**

Introduces first-year PhD students to the research of the School of Criminology and Criminal Justice's faculty. Offers students an opportunity to practice the key components of, and tools for, scholarly production, including formulating research questions and theses, conducting literature reviews and using databases, using citation software; time management and organizational strategies; and writing and presenting scholarship in the field, such as journal articles, conference presentations, and other scholarly outlets.

**CRIM 7002. PhD Pro-Seminar in Criminology and Justice Policy 2. (0 Hours)**

Continues and builds upon CRIM 7001. Introduces first-year PhD students to the research of the School of Criminology and Criminal Justice's faculty. Offers students an opportunity to practice the key components of, and tools for, scholarly production, including formulating research questions and theses, conducting literature reviews and using databases, using citation software; time management and organizational strategies; and writing and presenting scholarship in the field, such as journal articles, conference presentations, and other scholarly outlets.

**CRIM 7203. Theories of Criminal Justice Process. (4 Hours)**

Studies the theoretical and empirical foundations for fundamental criminal justice process theories. Organized around key theoretical frameworks that explain the activities and outputs of the criminal justice system. Identifies key elements of criminal justice process theories and examines how these components are defined, operationalized, and tested empirically. Offers students an opportunity to develop mastery of the administration of justice process by reviewing research critiquing justice system strategies, functioning, and effects. Students identify and consider changes in institutional responses to crime and justice issues that have occurred over time and across cultural contexts. Traces the role of systemic racism and intersecting dimensions of oppression in the historical development of and current policies and practices in the criminal justice system.

**CRIM 7700. Practicum in Teaching. (0 Hours)**

Provides weekly meetings for graduate student lecturers and faculty advisers to discuss common concerns and issues arising during the course of teaching. With input from the Center for Effective University Teaching, covers topics such as syllabus preparation, examination preparation and grading, classroom protocol, and student interaction. Required for all doctoral students teaching a class for the first time.

**CRIM 7706. Practicum in Writing and Publishing. (2 Hours)**

Offers students an opportunity to develop and improve their academic writing skills while preparing a sole-authored article for potential publication. Requires each student to present a paper in-progress and, through an iterative process of review and revision, have it ready to submit to a journal by the end of the semester. Students comment, orally and in writing, on the papers presented by the other students over the course of the semester. There are regular assignments from leading texts on mechanics and style in writing and reflections on the peer-review and publication processes from multiple perspectives. May be repeated once.

**CRIM 7710. Criminology and Public Policy 1. (4 Hours)**

Offers detailed coverage of theoretical criminology and its implications for public policy. Approaches the understanding of crime from an interdisciplinary perspective, focusing on recent theoretical developments. Studies the connections between systemic racism, inequalities, and crime and the role of bias in the development of the field and criminological theories. Emphasizes evaluating theory in light of empirical research, understanding the implications of theory and research for programs and policies of crime prevention and control, and evaluating current approaches to crime prevention and control.

**CRIM 7711. Criminology and Public Policy 2. (4 Hours)**

Covers theoretical criminology and its implications for public policy. Approaches the understanding of crime from an interdisciplinary perspective, with emphasis on recent theoretical developments. Analyzes the connections between systemic racism, inequalities, and crime and the role of bias in the development of the field and criminological theories. Emphasizes evaluating theory in light of empirical research, understanding the implications of theory and research for programs and policies of crime prevention and control, and evaluating current approaches to crime prevention and control.

**Prerequisite(s):** CRIM 7710 with a minimum grade of C-

**CRIM 7715. Multivariate Analysis 1. (4 Hours)**

Builds upon the concepts of correlation and inference to present analytic procedures involving several variables, including multiple regression, logistic regression, causal analysis, and multiway ANOVA. Emphasizes the application of these methods with criminal justice data sets using statistical software programs.

**Prerequisite(s):** INSH 5301 with a minimum grade of C or INSH 6500 with a minimum grade of C

**CRIM 7716. Multivariate Analysis 2. (4 Hours)**

Continues CRIM 7715. Covers more advanced multivariate analytic methods. Topics include principal components and factor analysis, discriminant analysis, MANOVA, time series, and cluster analysis. Emphasizes the application of these methods with criminal justice data sets using statistical software programs.

**Prerequisite(s):** CRIM 7715 with a minimum grade of C-

**CRIM 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CRIM 7976. Directed Study. (1-4 Hours)**

Offers the student the opportunity to bring individual, concentrated attention to a particular topic as arranged and agreed upon in advance by a faculty member and the student. This option is generally recommended when the student desires a more intensive analysis of a particular subject. May be repeated without limit.

**CRIM 7983. Topics in Criminal Justice and Criminology. (4 Hours)**

Offers intensive study of a topic related to criminal justice, selected by the instructor. May be repeated up to three times.

**CRIM 8960. Exam Preparation—Doctoral. (0 Hours)**

Offers the student the opportunity to prepare, under faculty supervision, for the PhD qualifying examination. May be repeated three times.

**CRIM 8984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**CRIM 8986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**CRIM 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**CRIM 9990. Dissertation Term 1. (0 Hours)**

Provides the student with the opportunity, under close faculty guidance, to conduct an original investigation of a criminal justice issue. Each student identifies a faculty chair and two additional faculty members who comprise the student's Dissertation Committee. While the student conducts research and develops a dissertation, the committee provides support and direction and, ultimately, approves the final research product.

**Prerequisite(s):** CRIM 9000 with a minimum grade of S

**CRIM 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** CRIM 9990 with a minimum grade of S

**CRIM 9996. Dissertation Continuation. (0 Hours)**

Offers continued thesis work conducted under the supervision of a departmental faculty.

**Prerequisite(s):** CRIM 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Criminal Justice - CPS (CJS)

### **CJS 6030. Organized Crime. (3 Hours)**

Surveys the history of organized crime around the world. Introduces the origins and activities of organized crime groups, policies designed to combat organized crime, and explanations for the persistence of organized crime. Also discusses new forms of organized crime.

### **CJS 6105. Domestic and International Terrorism. (3 Hours)**

Includes a general introduction to the overt as well as underlying ideology, history, reasons, and causes of terrorism. Discusses both domestic and international terrorism, with a focus on domestic hate groups, the roles of politics and the media, and counterterrorism. Exposes students to the philosophies of terrorists and terrorism.

### **CJS 6125. National Security—Law and Policy. (3 Hours)**

Examines the various elements of national power and their application in advancing U.S. interests. Explores the distribution of national security powers among the three branches of government. Offers students an opportunity to develop a recognition of the synergy a multidisciplined approach affords by analyzing current strategy and policy.

### **CJS 6430. Risk Management. (3 Hours)**

Provides a framework for an organizational leader to improve decision making through a comprehensive understanding of an organization's exposure to risk. Exposes students to skills for conducting these assessments across organizational boundaries and in public-private partnerships. Focuses on how to model, measure, or assess undesirable risks and reduce risks relevant to large organizations with collective public obligations. Emphasizes conducting homeland-security-related assessments across criminal justice disciplines and in public-private security collaborations.

### **CJS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Culture (CLTR)

### **CLTR 1000. Cultures, Societies, and Global Studies at Northeastern. (1 Hour)**

Introduces first-year students in the College of Social Sciences and Humanities to the liberal arts in general. Seeks to familiarize them with their major, to help them develop the academic skills necessary to succeed (analytical ability and critical thinking), to provide grounding in the culture and values of the university community, to help them develop interpersonal skills, and to familiarize them with all skills needed to become a successful university student.

### **CLTR 1120. Introduction to Languages, Literature, and Culture. (4 Hours)**

Examines the rich interconnections between literature and language and the culture that supports them. Discusses the relationship of language to literature and investigates how language and literatures are embedded in culture. Addresses several very broad and important questions, such as the relationship between language and culture; the relationship between language and thought; the definition of cultural relativism; and how ethical dilemmas are expressed in different cultures. Explores the relationship of esthetic and rhetorical traditions in given languages to the culture from which they sprang. In this context, examines the extremely interesting case of American Sign Language and how a gestural language sheds light on these issues.

**Attribute(s):** NUpath Interpreting Culture

### **CLTR 1500. Modern Chinese History and Culture. (4 Hours)**

Introduces modern Chinese history and culture through literary works, films, and historical texts. Examines political, social, and cultural changes in China since 1800: the decline of empire; the New Culture Movement of the 1920s; the rise of nationalism and rural revolution; the changing roles of women; the Cultural Revolution of the 1960s; and China's cinematic, literary, and economic engagement with the world since 1978. Taught in English and open to all undergraduates. CLTR 1500 and HIST 1500 are cross-listed.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**CLTR 1504. Cultural History of Spain. (4 Hours)**

Examines chronologically the forces that have forged Spanish culture and have made Spain the pluralistic society and multinational country it is today. Traces the development of the peoples of the Iberian Peninsula from prehistoric times to the present. Based primarily on the history of ideas, the arts, and architecture, incorporates history, sociology, anthropology, geography, economics, and politics. Conducted in English.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**CLTR 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CLTR 2001. World Cultures through Film. (4 Hours)**

Introduces the study of world cinema from the past several decades as a form of artistic and cultural expression. Emphasizes the way that different ethnicities and cultures mix and even clash within national boundaries. Readings cover such topics as the postcolonial inheritance, immigration, the boundaries of class, the pressures of modernization, ethnic identities, and historical memory. Examines storytelling in its multicultural aspects and deals with the diverse influences of entertainment cinema and art cinema, as well as measures taken by countries to limit the influx of foreign films in order to protect their own cultural productivity. One overall concern of the course is the place of film in contemporary global culture.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**CLTR 2973. Special Topics. (4 Hours)**

Offers intermediate-level study on a selected topic related to the interaction of a particular language with its literary or other cultural contexts. May be repeated twice for a maximum of 12 semester hours.

**CLTR 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CLTR 3418. Nationalism. (4 Hours)**

Explores contending theories of identity and nationalism—a powerful force in international and domestic politics. Examines topics such as the process of identity creation, the choice of national symbols, how group boundaries are established, the role of identity in conflict and state building, and the debate over nationalism's constructed or primordial nature. POLS 3418 and CLTR 3418 are cross-listed.

**Prerequisite(s):** POLS 1155 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**CLTR 3805. Culture, Politics, and Media in Spain. (4 Hours)**

Offers an in-depth critical inquiry into the current debates in the public sphere in Spain focusing on the politics of culture and identity as they both inform and challenge the very foundations of a modern nation-state. Arguably the first political entity in modern times to have been constructed as a state unified under one religion, one people, and one monarch, Spain is today an early example of a growing tendency toward national fragmentation and disintegration. Examines the ways in which current events in Spain may be the presage to an ever more unstable world order. Considers the possibility of a higher state of global governance beyond the nation-state and empire. Taught in English.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**CLTR 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CLTR 4655. Latin American Literature. (4 Hours)**

Offers an overview of the major trends in Latin American narrative, poetry, drama, and essays, from Bernal Diaz through Borges and Bolaño. Studies broad cultural and political contexts, especially the Cold War period and the impact of neoliberalism. Conducted in Spanish.

**Prerequisite(s):** SPNS 2101 with a minimum grade of D- or SPNS 2102 with a minimum grade of D- or SPNS 3101 with a minimum grade of D- or SPNS 3102 with a minimum grade of D-

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**CLTR 4944. Cultural Engagement Abroad. (4 Hours)**

Designed for a language-based Dialogue of Civilizations. Complements the intensive language course that students take while on a language-based Dialogue. Offers students an opportunity to obtain an in-depth knowledge of the contemporary culture(s) of the country of the Dialogue and how that culture differs from or is similar to contemporary American cultural values and practices. In addition to regular in-class lectures and activities, offers structured opportunities to engage in dialogue with businesspeople, scholars, educators, artists, government officials, journalists, students, senior citizens, and/or local residents about their perspectives on various topics and issues. May be repeated up to three times.

**CLTR 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CLTR 4992. Directed Study. (1-4 Hours)**

Offers students a way of going beyond work given in the regular curriculum; may also enable students to complete major or minor requirements in certain situations. Priority is given to language majors and to juniors and seniors. May be repeated without limit.

**Cybersecurity (CY)****CY 2550. Foundations of Cybersecurity. (4 Hours)**

Presents an overview of basic principles and security concepts related to information systems, including workstation security, system security, and communications security. Discusses legal, ethical, and human factors and professional issues associated with cybersecurity, including the ability to differentiate between laws and ethics. Offers students an opportunity to use a substantial variety of existing software tools to probe both computer systems and networks in order to learn how these systems function, how data moves within these systems, and how these systems might be vulnerable. Covers security methods, controls, procedures, economics of cybercrime, criminal procedure, and forensics.

**Prerequisite(s):** CS 2100 with a minimum grade of D- or CS 2500 with a minimum grade of D- or DS 2000 with a minimum grade of D- or DS 2500 with a minimum grade of D-

**CY 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CY 2991. Research in Cybersecurity. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated three times.

**CY 3740. Systems Security. (4 Hours)**

Introduces the fundamental principles of designing and implementing secure programs and systems. Presents and analyzes prevalent classes of attacks against systems. Discusses techniques for identifying the presence of vulnerabilities in system design and implementation, preventing the introduction of or successful completion of attacks, limiting the damage incurred by attacks, and strategies for recovering from system compromises. Offers opportunities for hands-on practice of real-world attack and defense in several domains, including systems administration, the Web, and mobile devices. Presents the ethical considerations of security research and practice.

**Prerequisite(s):** CS 3650 with a minimum grade of D-

**CY 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CY 4100. AI Security and Privacy. (4 Hours)**

Studies adversarial attacks on artificial intelligence that impact the security and privacy of these systems. Discusses mitigations against security and privacy vulnerabilities in AI models, and the challenges in making AI trustworthy. Offers an opportunity to read and debate contemporary papers at the forefront of machine learning and cybersecurity. Students develop and implement a semester-long project.

**Prerequisite(s):** CS 4100 with a minimum grade of D- or DS 4400 with a minimum grade of D-

**CY 4170. The Law, Ethics, and Policy of Data and Digital Technologies. (4 Hours)**

Describes the legal and ethical issues associated with collection, use, disclosure, and protection of digital information. Emphasizes legal infrastructure relating to privacy, data ethics, data security, hacking, automation, and intellectual property. Articulates the basic set of rules and rights that are relevant to data practices and protection, evaluates how these rules apply in context, and critically analyzes their efficacy and social impact.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Writing Intensive

**CY 4740. Network Security. (4 Hours)**

Studies topics related to Internet architecture and cryptographic schemes in the context of security. Provides advanced coverage of the major Internet protocols including IP and DNS. Examines denial of service, viruses, and worms, and discusses techniques for protection. Covers cryptographic paradigms and algorithms such as RSA and Diffie-Hellman in sufficient mathematical detail. The advanced topics address the design and implementation of authentication protocols and existing standardized security protocols. Explores the security of commonly used applications like the Web and e-mail.

**Prerequisite(s):** CS 3700 with a minimum grade of D- or CS 4700 with a minimum grade of D- or CS 4730 with a minimum grade of D- or CS 5700 with a minimum grade of C-

**CY 4760. Security of Wireless and Mobile Systems. (4 Hours)**

Presents the foundations to understand security and privacy threats as well as defenses in wireless and mobile systems, especially in the era of softwareization of wireless networks. Studies the proliferation of wireless systems within a wide variety of contexts such as telephony, navigation, sensor networks, and critical infrastructures. Examines the security challenges inherent in the broadcast nature of wireless technologies and the increased availability of software-defined radios. Offers students an opportunity to obtain experience in describing and classifying security goals and attacks in modern wireless networks, to identify the unique security implications of these effects, and how to mitigate security issues associated with them.

**CY 4770. Foundations of Cryptography. (4 Hours)**

Studies the design of cryptographic schemes that enable secure communication and computation. Emphasizes cryptography as a mathematically rigorous discipline with precise definitions, theorems, and proofs and highlights deep connections to information theory, computational complexity, and number theory. Topics include pseudorandomness; symmetric-key cryptosystems and block ciphers such as AES; hash functions; public-key cryptosystems, including ones based on factoring and discrete logarithms; signature schemes; secure multiparty computation and applications such as auctions and voting; and zero-knowledge proofs.

**Prerequisite(s):** (CS 3000 with a minimum grade of D- ; CS 3800 with a minimum grade of D-) or CS 4800 with a minimum grade of D-

**Attribute(s):** NUpath Formal/Quant Reasoning

**CY 4775. Applied Cryptography. (4 Hours)**

Provides an introduction to cryptography and its safe and efficient use in practical settings. Covers the fundamental principles of provable security properties of cryptographic primitives and the models used for reasoning about security. Provides in-depth coverage of important cryptographic primitives such as encryption, message authentication codes, hash functions, random number generation, and digital signatures. Balances proofs of security with hands-on development using established software libraries, enabling students to parameterize and use cryptographic primitives for computational and communication efficiency while retaining security guarantees.

**Prerequisite(s):** CS 3000 with a minimum grade of D- or CS 3800 with a minimum grade of D-

**CY 4930. Cybersecurity Capstone. (4 Hours)**

Provides the culmination of the learned principles and methodologies for identifying and addressing cybersecurity issues in organizations. Offers students an opportunity to work in small groups to identify and scope a current cybersecurity problem/challenge. Requires students to submit a written proposal about the project, complete with motivation, literature research, and reasons for the study; create a work plan to develop a solution to include the development and identification of the data necessary to properly solve the problem/challenge; and create a final report.

**Prerequisite(s):** CY 3740 with a minimum grade of D- or CY 4740 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**CY 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors in the discipline project.

**CY 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field.

**Prerequisite(s):** CY 4970 with a minimum grade of D-

**CY 4973. Topics in Cybersecurity. (4 Hours)**

Offers a lecture course in cybersecurity on a topic not regularly taught in a formal course. Topics may vary from offering to offering. May be repeated up to three times.

**Prerequisite(s):** CS 3000 with a minimum grade of D- ; (CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- or DS 3500 with a minimum grade of D- )

**CY 5001. Cybersecurity: Technologies, Threats, and Defenses. (4 Hours)**

Seeks to provide a systematic understanding of cyberspace technology and applications deployed in the global digital infrastructure. Covers topics in computer networks, server architectures, operating systems, and scripting. All the techniques and tools included in the course are oriented to serve as instruments of security administrators and cybersecurity professionals. Uses practical hands-on labs running on virtual machines and containers hosted in the cloud computing environment to train students. For that reason, a practical overview of virtualization technologies, containerization, and cloud computing models is provided.

**CY 5003. Foundations of Software Security. (4 Hours)**

Provides an overview of various software security threats and some of the most effective countermeasures used to thwart both well-known and newly emerging software security threats. Introduces best practices and tools available to help minimize common software security attacks, recognizing that it is impossible to accomplish "perfect security" in software. Also studies secure coding concepts, tools, and practices in a high-level programming language.

**CY 5010. Cybersecurity Principles and Practices. (4 Hours)**

Introduces information security via concepts of confidentiality, integrity, and availability. Discusses ethical, legal, and privacy ramifications while reviewing various laws, such as the Patriot Act, the Gramm-Leach-Bliley Act, and the General Data Protection Regulation. Covers security methods, controls, procedures, economics of cybercrime, criminal procedure, and forensics.

**CY 5065. Cloud Security Practices. (4 Hours)**

Introduces the fundamentals of cloud computing. Examines the strategies to implement security controls, perform risk assessments, and handle incident detection and response. Emphasizes maintenance of a business-minded security life cycle for cloud-based environments. Offers students an opportunity to obtain an understanding of various security challenges, threat models, and data privacy issues in regard to compliance and legal implications.

**Prerequisite(s):** CY 5010 with a minimum grade of C-

**CY 5120. Applied Cryptography. (4 Hours)**

Surveys the principles and the practices of cryptography. Overviews the core cryptographic algorithms: symmetric encryption schemes (e.g., DES and AES); public key cryptosystems (e.g., RSA and discrete logarithm); and hash functions (e.g., the SHA family). Discusses core information assurance building blocks, such as authentication, digital signatures, key management, and digital certificates. Finally, applies these concepts to important security architectures, including the IP network stack (e.g., IPsec and SSL/TLS), the cellular system, and broadcast media.

**Prerequisite(s):** CY 5001 with a minimum grade of C- or CY 5010 with a minimum grade of C-

**CY 5130. Computer System Security. (4 Hours)**

Offers a practical overview of enterprise computer security, operating systems security, and related topics. Applies concepts such as authentication, access control, integrity, and audit to the modern operating system. Discusses and demonstrates system, process, memory, and file system-level defenses—and the attacks against them. Also discusses topics in data security and virtualization. Uses hands-on labs to reinforce skills and provide practical experience.

**Prerequisite(s):** CY 5001 with a minimum grade of C- or CY 5010 with a minimum grade of C-

**CY 5150. Network Security Practices. (4 Hours)**

Explores issues involved in the security of computer networks. Topics include firewalls, viruses, virtual private networks, Internet security, and wireless security. Includes case studies and laboratory exercises.

**Prerequisite(s):** CY 5001 with a minimum grade of C- or CY 5010 with a minimum grade of C-

**CY 5200. Security Risk Management and Assessment. (4 Hours)**

Creates the opportunity for competency in the development of information security policies and plans including controls for physical, software, and networks. Discusses different malicious attacks, such as viruses and Trojan horses, detection strategies, countermeasures, damage assessment, and control. Covers information system risk analysis and management, audits, and log files. Uses case studies, site visits, and works with commercial products.

**Prerequisite(s):** CS 2550 with a minimum grade of D- or CY 2550 with a minimum grade of D- or IA 5010 with a minimum grade of C- or CY 5010 with a minimum grade of C- or graduate program admission

**CY 5210. Information System Forensics. (4 Hours)**

Designed to allow students to explore the techniques used in computer forensic examinations. Examines computer hardware, physical and logical disk structure, and computer forensic techniques. Conducts hands-on experiences on DOS, Windows operating systems, Macintosh, Novell, and Unix/Linux platforms. Builds on basic computer skills and affords hands-on experience with the tools and techniques to investigate, seize, and analyze computer-based evidence using a variety of specialized forensic software in an IBM-PC environment.

**Prerequisite(s):** CS 2550 with a minimum grade of D- or CY 2550 with a minimum grade of D- or IA 5010 with a minimum grade of C- or CY 5010 with a minimum grade of C- or graduate program admission

**CY 5240. Cyberlaw: Privacy, Ethics, and Digital Rights. (4 Hours)**

Describes the legal and ethical issues associated with information security including access, use, and dissemination. Emphasizes legal infrastructure relating to information assurance, such as the Digital Millennium Copyright Act and Telecommunications Decency Act, and emerging technologies for management of digital rights. Examines the role of information security in various domains such as healthcare, scientific research, and personal communications such as email. Examines criminal activities such as computer fraud and abuse, desktop forgery, embezzlement, child pornography, computer trespass, and computer piracy.

**Prerequisite(s):** CS 2550 with a minimum grade of D- or CY 2550 with a minimum grade of D- or IA 5010 with a minimum grade of C- or CY 5010 with a minimum grade of C- or graduate program admission

**Attribute(s):** NUpath Ethical Reasoning, NUpath Writing Intensive

**CY 5250. Decision Making for Critical Infrastructure. (4 Hours)**

Focuses on the art and science of security program management leadership in the context of critical infrastructure protection programs. Includes selected readings, review of decision-making models in crisis, lectures and insights from accomplished leaders in infrastructure protection, and examination of the students' own unique background and experiences. Trains students on the interaction of vulnerabilities, threats, and countermeasures and how to apply this knowledge to the protection of critical infrastructure using research and analysis of national and global strategies, historical and current legislation, and policies. Also seeks to give students a working knowledge of federal, state, and private-sector critical infrastructure protection resources and programs.

**CY 5770. Software Vulnerabilities and Security. (4 Hours)**

Seeks to help students to become aware of systems security issues and to gain a basic understanding of security. Presents the principal software and applications used in the Internet, discussing in detail the related vulnerabilities and how they are exploited. Also discusses programming vulnerabilities and how they are exploited. Examines protection and detection techniques. Includes a number of practical lab assignments as well as a discussion of current research in the field.

**Prerequisite(s):** CY 5001 with a minimum grade of C- or CY 5010 with a minimum grade of C-

**CY 5976. Directed Study. (1-4 Hours)**

Seeks to provide cybersecurity (CY) students with the training experience of working on a specific IA project under the direction of an CY instructor. The instructor provides students with a plan of seminar sessions, including lectures, research, and development of project deliverables and with direction to complete the course. May be repeated without limit.

**CY 5984. Research. (2-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**CY 6120. Software Security Practices. (4 Hours)**

Explores the fundamentals of software security issues from a practical perspective. Takes a deeper dive into the low-level mechanisms used in a variety of most prevalent software security issues and discusses some of the industry best practices needed to address the issues. Offers students an opportunity to learn both an attacker's and defender's perspectives when it comes to software security issue exploitation, detection, and mitigation. Incorporates a number of practical C and assembly coding and lab assignments. Includes an overview of some of the state-of-the-art software security issue exploitation and mitigation techniques used in the field.

**Prerequisite(s):** CY 5010 with a minimum grade of C-

**CY 6200. Special Topics in IT Security Governance, Risk, and Compliance. (1-4 Hours)**

Offers various topics in IT security governance, risk, and compliance. May be repeated for up to 8 total credits.

**CY 6740. Network Security. (4 Hours)**

Studies the theory and practice of computer security, focusing on the security aspects of multiuser systems and the Internet. Introduces cryptographic tools, such as encryption, key exchange, hashing, and digital signatures in terms of their applicability to maintaining network security. Discusses security protocols for mobile networks. Topics include firewalls, viruses, Trojan horses, password security, biometrics, VPNs, and Internet protocols such as SSL, IPSec, PGP, SNMP, and others.

**Prerequisite(s):** CY 5001 with a minimum grade of C- or CY 5010 with a minimum grade of C- or CS 5700 with a minimum grade of C-

**CY 6760. Wireless and Mobile Systems Security. (4 Hours)**

Focuses on security and privacy of mobile and wireless systems. Provides the foundations to understand the security and privacy threats and defenses in wireless and mobile systems, especially in an era where wireless network functions are implemented in software instead of traditional hardware-based solutions. Covers topics on availability/integrity issues in wireless networks, Wi-Fi and cellular network security, broadcast authentication techniques, jamming and antijamming techniques, etc. Emphasizes hands-on practical exercises to strengthen the understanding of concepts covered during the lectures. Reviews the state of the art in wireless security research through readings. Offers students an opportunity to execute a semester-long project in the broad area of wireless security.

**CY 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CY 7790. Special Topics in Security and Privacy. (4 Hours)**

Offers various topics in security and privacy. May be repeated for up to 8 total credits.

**CY 7900. Capstone Project. (4 Hours)**

Draws together candidates from diverse backgrounds (technical, legal, and/or law enforcement) in a collaborative activity to address one or more security issues from an integrated perspective. Requires a project proposal, generally industrially oriented, to be submitted and accepted prior to the semester in which the project is to be undertaken.

**CY 7962. Elective. (2-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**CY 7990. Thesis. (2-4 Hours)**

Offers selected work with the agreement of a project supervisor. May be repeated without limit.

**CY 7995. Project. (1-4 Hours)**

Offers students an opportunity to participate in a direct cybersecurity project under the supervision of a faculty member. May be repeated once for a total of 8 credits.

**CY 8982. Readings. (1-8 Hours)**

Offers selected readings under the supervision of a faculty member. May be repeated without limit.

**CY 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of program requirements for PhD candidacy.

**CY 9990. Dissertation Term 1. (0 Hours)**

Offers selected work with the agreement of a thesis supervisor.

**Prerequisite(s):** CY 9000 with a minimum grade of S

**CY 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** CY 9990 with a minimum grade of S

**CY 9996. Dissertation Continuation. (0 Hours)**

Continues work with the agreement of a thesis supervisor.

**Prerequisite(s):** CY 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Data Analytics and Decision Support (DADS)

**DADS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**DADS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**DADS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**DADS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**DADS 5200. Mathematics for Machine Learning. (4 Hours)**

Covers mathematical concepts essential for understanding machine learning algorithms. Builds foundational knowledge in linear algebra, analytic geometry, matrix decompositions, probability, optimization, and specific models such as Gaussian mixture models.

**Prerequisite(s):** (IE 3412 with a minimum grade of C- or IE 4515 with a minimum grade of C- or MATH 3081 with a minimum grade of C- ) or graduate program admission

**DADS 6205. Deterministic Operations Research. (4 Hours)**

Introduces the theory, computation, and application of deterministic models to represent industrial operations. Includes linear programming formulation and solution using spreadsheet and algebraic languages software; simplex, big-M, two-phase, revised simplex, and dual simplex algorithms for solving linear programs; introduction to the theory of simplex, fundamental insight, duality, and sensitivity analysis; transportation, assignment, and transshipment problems; shortest path, minimum spanning tree, maximum flow, minimum cost network flow problems and project networks; and discrete-state and continuous-state dynamic programming models and applications. Requires knowledge of linear algebra.

**DADS 6400. Foundations for Data Analytics. (4 Hours)**

Introduces fundamental concepts and methods in data analytics engineering, with a focus on probability, eigenvalues and eigenvectors, cluster analysis, text mining, and time series analysis. Covers modern data structures and computational techniques for data cleaning and wrangling. Prepares students for advanced coursework in data analytics.

**DADS 6600. Computation and Visualization for Analytics. (4 Hours)**

Explores visualization tools and techniques for data exploration, knowledge discovery, data storytelling, and decision making in engineering, healthcare operations, and manufacturing. Covers Python and R for data mining and visualization. Examines static and interactive visualization methods that reveal patterns, interactions, and comparisons, with a focus on color encoding, shape selection, spatial layout, and annotation.

**DADS 6700. Data Management for Analytics. (4 Hours)**

Covers the theory and applications of database management to support data analytics, data mining, machine learning, and artificial intelligence. Discusses the fundamental concepts and emerging technologies in database design and modeling, database systems, data storage, and the evolving world of data warehousing and data governance. Presents a balanced theory-practice focus. Covers relational databases, NoSQL databases, data integration, data quality, data governance, Big Data, and data processing for analytics.

**DADS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**DADS 7275. Machine Learning and Data Analytics. (4 Hours)**

Covers the theory and applications of machine learning in data analytics. Reviews fundamental concepts and key principles of machine learning, explores essential data analytics techniques, and presents algorithms for their implementation. Focuses on techniques for data preprocessing, feature selection, classification, regression, clustering, and advanced data exploration in data-driven decision making. Discusses applications of machine learning and data analytics in various domains including manufacturing, healthcare, medicine, business, and other service sectors.

**Prerequisite(s):** IE 5374 with a minimum grade of D or IE 5374 with a minimum grade of C (Graduate) or IE 6200 with a minimum grade of C or IE 6400 with a minimum grade of C or MATH 7241 with a minimum grade of C

**DADS 7305. Machine Learning Operations. (4 Hours)**

Focuses on the integration of machine learning with production-level infrastructure, emphasizing the full life cycle of model development, deployment, and monitoring. Highlights tools and best practices for scalable, reproducible, and automated ML operations. Covers continuous integration and delivery, containerization, orchestration, experiment tracking, and automated retraining using platforms such as TFX, MLflow, Airflow, Docker, Kubernetes, and Google Cloud Platform.

**Prerequisite(s):** CS 6120 with a minimum grade of C or CS 6140 with a minimum grade of C or CS 6180 with a minimum grade of C or CS 6220 with a minimum grade of C or CS 7140 with a minimum grade of C or CS 7150 with a minimum grade of C or IE 7300 with a minimum grade of C

**DADS 7650. Deep Generative Models. (4 Hours)**

Examines theoretical foundations of generative AI across natural language processing and computer vision. Covers deep learning architectures including autoencoders, GANs, diffusion models, and transformers. Investigates applications such as text generation, image synthesis, and retrieval-augmented generation. Reinforces concepts through a structured lab sequence that supports practical understanding and ethical considerations in AI development.

**Prerequisite(s):** CS 6140 with a minimum grade of C+ or IE 7300 with a minimum grade of C+

**Data Analytics (DA)****DA 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DA 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DA 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DA 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DA 5020. Collecting, Storing, and Retrieving Data. (4 Hours)**

Studies how to build large-scale information repositories of different types of information objects so that they can be selected, retrieved, and transformed for analytics and discovery, including statistical analysis. Analyzes how traditional approaches to data storage can be applied alongside modern approaches that use nonrelational data structures. Through case studies, readings on background theory, and hands-on experimentation, offers students an opportunity to learn how to select, plan, and implement storage, search, and retrieval components of large-scale structured and unstructured information repositories. Emphasizes how to assess and recommend efficient and effective large-scale information storage and retrieval components that provide data scientists with properly structured, accurate, and reliable access to information needed for investigation.

**DA 5030. Introduction to Data Mining/Machine Learning. (4 Hours)**

Introduces the fundamental techniques for data mining, combining elements from CS 6140 and CS 6220. Discusses several basic learning algorithms, such as regression and decision trees, along with popular data types, implementation and execution, and analysis of results. Lays the data analytics program foundation of how learning models from data work, both algorithmically and practically. The coding can be done in R, Matlab or Python. Students must demonstrate ability to set up data for learning, training, testing, and evaluating.

**DA 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Data Architecture Management (DAMG)****DAMG 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DAMG 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DAMG 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DAMG 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DAMG 5210. Introduction to Data Management and Database Design. (4 Hours)**

Presents insights from a data perspective for engineering and business applications; data modeling, relational algebra, including entity-relationship and object approaches; user-centric information requirements and data sharing; fundamental concepts of database management systems and their applications; alternative data models, emphasizing relational design; SQL; data normalization; data-driven application design for personal computer, server-based, enterprise-wide, and internet databases; and SQL injection and distributed data applications.

**DAMG 5374. Special Topics in Data Architecture and Management. (1-4 Hours)**

Offers topics of current interest in data architecture and management. May be repeated up to three times for a maximum of 16 semester hours.

**DAMG 5976. Directed Study. (1-4 Hours)**

Offers theoretical or experimental work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated up to seven times for a maximum of 8 semester hours.

**DAMG 6105. Data Science Engineering with Python. (4 Hours)**

Studies the Python programming language with data science as the application domain. Offers students an opportunity to learn how to perform complex numerical calculations, fixed data types, space efficiency, and vector manipulations. Covers tools and techniques for manipulating tables, spreadsheets, and group and pivot tables involving extremely large data sets. Covers large multidimensional arrays and matrices and the high-level mathematical functions to operate on these arrays. Studies how to use Python to manipulate the classic math and science algorithms. Analyzes helper functions such as linear and nonlinear regression, integration, Fourier transformations, numerical optimization, etc. Includes higher-level classes for manipulating and visualizing data. Applies tools and techniques to classical data science using cases such as time series forecasting, social network analysis, text analytics, and big data processing.

**DAMG 6210. Data Management and Database Design. (4 Hours)**

Studies design of information systems from a data perspective for engineering and business applications; data modeling, including entity-relationship (E-R) and object approaches; user-centric information requirements and data sharing; fundamental concepts of database management systems (DBMS) and their applications; alternative data models, with emphasis on relational design; SQL; data normalization; data-driven application design for personal computer, server-based, enterprise-wide, and Internet databases; and distributed data applications.

**DAMG 6374. Special Topics in Data Architecture and Management. (1-4 Hours)**

Offers topics of current interest in data architecture and management. May be repeated up to three times for a maximum of 16 semester hours.

**DAMG 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DAMG 7105. Intelligent Data Modeling and Presentation for Engineers. (4 Hours)**

Studies every step in a data analysis pipeline and the visual techniques that aid in understanding the quality of each step. Offers students an opportunity to visualize the quality of their data, learn how to fix issues, and then visualize what those fixes helped. Focuses on visualizing models to produce actionable insights and how to visualize causal relationships in models. Emphasizes attention to graphical machine-learning models and how to visualize the critical parts of a network. Covers graphic design principles to assist students to effectively communicate their findings.

**Prerequisite(s):** INFO 5002 with a minimum grade of B or INFO 6105 with a minimum grade of B or DAMG 6105 with a minimum grade of B

**DAMG 7245. Big-Data Systems and Intelligence Analytics. (4 Hours)**

Offers students an opportunity to learn a hands-on approach to understanding how large-scale data sets are processed and how data science algorithms are adopted in the industry through case studies and labs. This project-based course builds on INFO 7390 and focuses on enabling students with tools and frameworks primarily to build end-to-end applications. The course is divided into three parts: building the data pipeline for data science, implementing data science algorithms, and scaling and deploying data science algorithms.

**Prerequisite(s):** DAMG 6105 with a minimum grade of B or INFO 6105 with a minimum grade of B

**DAMG 7250. Big Data Architecture and Governance. (4 Hours)**

Focuses on creating and managing a data-driven enterprise. Geared to current IT technical professionals, data scientists, technical project managers, aspiring IT professionals, and managers who want to understand the complex nature of creating and managing data-driven projects to support the new and legacy data environments. Covers the analysis that is required to design data-driven projects and make appropriate recommendations for the target state of an organization. This analysis is used as input to create a comprehensive road map to achieve the target state and includes current and future uses of data, consumption methods, data sources and categories, and aggregation and quality requirements.

**Prerequisite(s):** CSYE 6200 with a minimum grade of B or DAMG 6105 with a minimum grade of B or DAMG 6210 with a minimum grade of B or INFO 5100 with a minimum grade of B or INFO 6210 with a minimum grade of B

**DAMG 7275. Advanced Database Management Systems. (4 Hours)**

Introduces the skill set required to become a serious database applications developer. Offers an overview of the Oracle9i object-relational database system for those who have mastered the fundamental principles of database design and are competent with basic SQL. Gives students the opportunity to develop a strong understanding of the PL/SQL programming language, which is used to create triggers, user-generated functions, stored procedures, and packages for programming Oracle objects. Emphasizes advanced SQL features and Oracle-specific SQL enhancements. Covers optimization and tuning issues. Covers corresponding material for Transact-SQL (used for Microsoft SQL Server and Sybase database systems) as time and resources permit.

**Prerequisite(s):** DAMG 6210 with a minimum grade of B or INFO 6210 with a minimum grade of B

**DAMG 7290. Data Warehousing and Business Intelligence. (4 Hours)**

Examines the technical and management aspects of building a data warehouse. Explores the architecture, infrastructure, processes, data quality, database design, and data analysis involved in building the data warehouse for business analysis. Management issues include business goals, tool selection, project management, personnel skills, training, and user requirements. Topics include dimensional data modeling, extraction/transformation/load processes, data quality problems, datamarts, operational data stores (ODS), staging databases, and online analytic processing (OLAP).

**Prerequisite(s):** DAMG 6210 with a minimum grade of B or DAMG 7275 with a minimum grade of B or INFO 6205 with a minimum grade of B or INFO 6210 with a minimum grade of B

**DAMG 7325. Introduction to Information Technology Auditing. (4 Hours)**

Presents a foundation for the study and professional career development of information technology auditing. Introduces the fundamentals of IT auditing, core reasons why this is a specialized area of auditing, the principle objectives of IT auditing, and its relationship to integrated financial or operational auditing. Also offers insight into management's objectives regarding IT risk management. Uses the COBIT governance and control framework to emphasize management issues regarding control of IT and the achievement of value through managed IT processes. Covers three primary types of IT audits: the audits of computerized information systems, IT processing environments, and the process of developing and implementing information systems.

**Prerequisite(s):** DAMG 6105 with a minimum grade of B ; (DAMG 6210 with a minimum grade of B or INFO 6210 with a minimum grade of B )

**DAMG 7330. Cybersecurity Audit and Compliance. (4 Hours)**

Introduces the fundamentals of IT audit and cybersecurity compliance by exploring the evolving role of cybersecurity in organizational compliance strategies. Emphasizes the audit principles, regulatory frameworks, and the integration of compliance into organizational operations. Uses real-world scenarios and case studies to navigate the complexities of audit preparation, manage compliance within regulatory frameworks, and respond to incidents from a compliance perspective. Offers a strong foundation for those looking to advance their careers in IT auditing, cybersecurity, or compliance management, including practical skills and insights for real-world application.

**DAMG 7350. Systems and Cybersecurity Fundamentals. (4 Hours)**

Presents the principles of data and technology that define systems and cybersecurity from a socio-technical perspective. Offers students an opportunity to gain insight into the importance of systems security within cybersecurity and the integral role that information systems analysts play in developing cybersecure systems that people use. Through hands-on dynamic learning, students explore foundational cybersecurity principles, security architecture, risk management, attacks and mitigation strategies using Kali Linux, cyber incident response, and emerging IT/IS technologies.

**Prerequisite(s):** DAMG 6105 with a minimum grade of B ; (DAMG 6210 with a minimum grade of B or INFO 6210 with a minimum grade of B )

**DAMG 7370. Designing Advanced Data Architectures for Business Intelligence. (4 Hours)**

Focuses on designing advanced data architectures supporting structured, unstructured, and semistructured data sources; hybrid integration and data engineering; and analytical uses by casual information consumers, power users, and data scientists. Technologies include databases (relational, columnar, in-memory, and NoSQL); hybrid data, application, and cloud integration; data preparation; data virtualization; descriptive, diagnostic, predictive, and prescriptive analytics; and on-premise and on-cloud deployments. Topics include data structures, data models, data integration workflow and data engineering, data integration, data preparation, and data virtualization.

**Prerequisite(s):** DAMG 6210 with a minimum grade of B or INFO 6210 with a minimum grade of B

**DAMG 7374. Special Topics in Data Architecture and Management. (1-4 Hours)**

Offers topics of current interest in data architecture and management. May be repeated without limit.

**DAMG 7390. Advances in Hybrid Data Integration and Engineering. (4 Hours)**

Offers students an opportunity to understand concepts on integration use cases, integration processes and personae, data governance (with privacy and security), and data management, in an era when enterprises are increasingly adding, expanding, and altering data sources. While gathering data is often straightforward, enterprises struggle to integrate, cleanse, curate, transform, and govern data to deliver comprehensive and consistent data to support operations and enable analytics. Covers real-world integration use cases that present data fragmentation, data inconsistency, and data quality challenges and effective architectures needed to design, develop, and implement hybrid integration platforms. Studies how to apply theory and best and pragmatic practices with various technologies to implement hybrid integration platform solutions.

**Prerequisite(s):** DAMG 7370 with a minimum grade of B-

**DAMG 7945. Master's Project. (4 Hours)**

Delves deeply into advanced concepts and methodologies within data architecture and management. Emphasizes the development of critical thinking skills and the practical application of theoretical knowledge to real-world problems in the field. Through individual efforts, including laboratory work and/or literature review, students thoroughly explore and analyze various aspects of data architecture and management, focusing on a project selected in consultation with their faculty advisor that allows for tailored exploration and research. Students compile a comprehensive report detailing their findings, methodologies, and conclusions. Offers students an opportunity to present their discoveries to peers and faculty, fostering scholarly discussion and collaboration.

**DAMG 7976. Directed Study. (1-4 Hours)**

Offers theoretical or experimental work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated up to seven times for a maximum of 8 semester hours.

**DAMG 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**DAMG 7990. Thesis. (4 Hours)**

Offers theoretical and experimental work conducted under the supervision of a departmental faculty.

**Prerequisite(s):** DAMG 7945 with a minimum grade of C-

**Data Science (DS)****DS 1300. Knowledge in a Digital World. (4 Hours)**

Examines the impact that information technologies (such as the internet, search engines, blogs, wikis, and smartphones); information processing techniques (such as big data analysis, machine learning, crowdsourcing, and cryptography); and information policies (such as privacy norms and speech restrictions) have on what we know and how much we know, as individuals and as a society. The digital world can enhance our ability to acquire knowledge by providing us with fast and cheap access to huge amounts of information. However, it can also undermine our cognitive abilities and provide us with inaccurate or misleading information. Studies normative frameworks from epistemology and ethics (such as epistemic value theory, the extended mind hypothesis, and moral rights) to evaluate these technologies and policies.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**DS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DS 2500. Intermediate Programming with Data. (4 Hours)**

Offers intermediate to advanced Python programming for data science. Covers object-oriented design patterns using Python, including encapsulation, composition, and inheritance. Advanced programming skills cover software architecture, recursion, profiling, unit testing and debugging, lineage and data provenance, using advanced integrated development environments, and software control systems. Uses case studies to survey key concepts in data science with an emphasis on machine-learning (classification, clustering, deep learning); data visualization; and natural language processing. Additional assigned readings survey topics in ethics, model bias, and data privacy pertinent to today's big data world. Offers students an opportunity to prepare for more advanced courses in data science and to enable practical contributions to software development and data science projects in a commercial setting.

**Prerequisite(s):** DS 2000 with a minimum grade of D-

**Corequisite(s):** DS 2501

**Attribute(s):** NUpath Analyzing/Using Data

**DS 2501. Lab for DS 2500. (1 Hour)**

Practices the programming techniques discussed in DS 2500 through hands-on experimentation.

**Corequisite(s):** DS 2500

**DS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DS 2991. Research in Data Science. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated three times.

**DS 3000. Foundations of Data Science. (4 Hours)**

Introduces methods and concepts from linear algebra and probability that form a basis for modern machine learning. Emphasizes computational aspects using the Python programming language (the course assumes familiarity with Python). Students work with tensors (in NumPy) and may be tasked with implementing from scratch algorithms central to numerical linear algebra and introductory machine learning.

**Prerequisite(s):** CS 2100 with a minimum grade of D- or CS 2510 with a minimum grade of D- or DS 2500 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**DS 3050. Information and Uncertainty. (4 Hours)**

Introduces the foundations of probabilistic inference, information theory, and their uses for drawing conclusions from noisy data. Applications include diagnosing diseases with inconclusive medical tests, locating autonomous vehicles when sensors are imperfect, and how best to make inferences with incomplete or partial information. Central topics include distinguishing deductive and probabilistic inference, philosophical interpretations of probability, fundamental justifications for the rules of probability, and key concepts of information theory. Introduces analytic and mathematical methods of analysis in these cases and contemporary computational (i.e., programming) techniques for implementing and applying theories of information and probabilistic inference.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**DS 3500. Advanced Programming with Data. (4 Hours)**

Offers a deep dive into the design and implementation of enterprise-grade software systems with an emphasis on software architectures for more complex data-driven applications. Covers extensible architectures that support testing, data provenance, reuse, maintainability, scalability, and robustness and building software APIs and libraries for wide-scale adoption and ease of use. Students design, implement, and test complex loosely coupled service-oriented architectures using distributed processing, stream-based data processing, and interprocess communication via message passing. Explores the features, capabilities, and underlying design of popular data analysis and visualization frameworks.

**Prerequisite(s):** DS 2500 with a minimum grade of D-

**DS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DS 4200. Information Presentation and Visualization. (4 Hours)**

Introduces foundational principles, methods, and techniques of visualization to enable creation of effective information representations suitable for exploration and discovery. Covers the design and evaluation process of visualization creation, visual representations of data, relevant principles of human vision and perception, and basic interactivity principles. Studies data types and a wide range of visual data encodings and representations. Draws examples from physics, biology, health science, social science, geography, business, and economics. Emphasizes good programming practices for both static and interactive visualizations. Creates visualizations in Excel and Tableau as well as R, Python, and open web-based authoring libraries. Requires programming in Python, JavaScript, HTML, and CSS. Requires extensive writing including documentation, explanations, and discussions of the findings from the data analyses and the visualizations.

**Prerequisite(s):** CS 2100 with a minimum grade of D- or CS 2510 with a minimum grade of D- or DS 2500 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Writing Intensive

**DS 4300. Large-Scale Information Storage and Retrieval. (4 Hours)**

Introduces data and information storage approaches for structured and unstructured data. Covers how to build large-scale information storage structures using distributed storage facilities. Explores data quality assurance, storage reliability, and challenges of working with very large data volumes. Studies how to model multidimensional data. Implements distributed databases. Considers multiter storage design, storage area networks, and distributed data stores. Applies algorithms, including graph traversal, hashing, and sorting, to complex data storage systems. Considers complexity theory and hardness of large-scale data storage and retrieval. Requires use of nonrelational, document, key-column, key-value, and graph databases and programming in R, Python, and C++.

**Prerequisite(s):** (CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- or DS 3500 with a minimum grade of D-); CS 3200 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**DS 4400. Machine Learning and Data Mining 1. (4 Hours)**

Introduces supervised and unsupervised predictive modeling, data mining, and machine-learning concepts. Uses tools and libraries to analyze data sets, build predictive models, and evaluate the fit of the models. Covers common learning algorithms, including dimensionality reduction, classification, principal-component analysis, k-NN, k-means clustering, gradient descent, regression, logistic regression, regularization, multiclass data and algorithms, boosting, and decision trees. Studies computational aspects of probability, statistics, and linear algebra that support algorithms, including sampling theory and computational learning. Requires programming in R and Python. Applies concepts to common problem domains, including recommendation systems, fraud detection, or advertising.

**Prerequisite(s):** (CS 2810 with a minimum grade of D- or DS 3000 with a minimum grade of D-); (CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- or DS 3500 with a minimum grade of D-)

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Capstone Experience, NUpath Writing Intensive

**DS 4420. Machine Learning and Data Mining 2. (4 Hours)**

Continues with supervised and unsupervised predictive modeling, data mining, and machine-learning concepts. Covers mathematical and computational aspects of learning algorithms, including kernels, time-series data, collaborative filtering, support vector machines, neural networks, Bayesian learning and Monte Carlo methods, multiple regression, and optimization. Uses mathematical proofs and empirical analysis to assess validity and performance of algorithms. Studies additional computational aspects of probability, statistics, and linear algebra that support algorithms. Requires programming in R and Python. Applies concepts to common problem domains, including spam filtering.

**Prerequisite(s):** DS 4400 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Capstone Experience, NUpath Writing Intensive

**DS 4440. Practical Neural Networks. (4 Hours)**

Offers a hands-on introduction to modern neural network ("deep learning") methods and tools. Covers fundamentals of neural networks and introduces standard and new architectures from simple feedforward networks to recurrent and "transformer" architectures. Also covers stochastic gradient descent and backpropagation, along with related parameter estimation techniques. Emphasizes using these technologies in practice, via modern toolkits. Reviews applications of these models to various types of data, including images and text.

**Prerequisite(s):** DS 4400 (may be taken concurrently) with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**DS 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors in the discipline project.

**DS 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field.

**Prerequisite(s):** DS 4970 with a minimum grade of D-

**DS 4973. Topics in Data Science. (4 Hours)**

Offers a lecture course in data science on a topic not regularly taught in a formal course. Topics may vary from offering to offering. May be repeated up to four times.

**Prerequisite(s):** CS 3000 with a minimum grade of D- ; (CS 3100 with a minimum grade of D- or CS 3500 with a minimum grade of D- or DS 3500 with a minimum grade of D- )

**DS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DS 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**DS 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. May be repeated without limit.

**DS 4996. Experiential Education Directed Study. (1-4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major. Restricted to those students who are using it to fulfill their experiential education requirement. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**DS 4997. Data Science Thesis. (4 Hours)**

Offers students an opportunity to prepare an undergraduate thesis under faculty supervision.

**DS 4998. Data Science Thesis Continuation. (4 Hours)**

Focuses on student continuing to prepare an undergraduate thesis under faculty supervision.

**DS 5010. Introduction to Programming for Data Science. (4 Hours)**

Offers an introductory course on fundamentals of programming and data structures. Covers lists, arrays, trees, hash tables, etc.; program design, programming practices, testing, debugging, maintainability, data collection techniques, and data cleaning and preprocessing. Includes a class project, where students use the concepts covered to collect data from the web, clean and preprocess the data, and make it ready for analysis.

**DS 5020. Introduction to Linear Algebra and Probability for Data Science. (4 Hours)**

Offers an introductory course on the basics of statistics, probability, and linear algebra. Covers random variables, frequency distributions, measures of central tendency, measures of dispersion, moments of a distribution, discrete and continuous probability distributions, chain rule, Bayes' rule, correlation theory, basic sampling, matrix operations, trace of a matrix, norms, linear independence and ranks, inverse of a matrix, orthogonal matrices, range and null-space of a matrix, the determinant of a matrix, positive semidefinite matrices, eigenvalues, and eigenvectors.

**DS 5110. Essentials of Data Science. (4 Hours)**

Introduces students to the core tasks in data science, including data collection, storage, tidying, transformation, processing, management, and modeling for the purpose of extracting knowledge from raw observations. Programming is a cross-cutting aspect of the course. Offers students an opportunity to gain experience with data science tasks and tools through short assignments. Includes a term project based on real-world data.

**DS 5220. Supervised Machine Learning and Learning Theory. (4 Hours)**

Introduces supervised machine learning, which is the study and design of algorithms that enable computers/machines to learn from experience or data, given examples of data with a known outcome of interest. Offers a broad view of models and algorithms for supervised decision making. Discusses the methodological foundations behind the models and the algorithms, as well as issues of practical implementation and use, and techniques for assessing the performance. Includes a term project involving programming and/or work with real-world data sets. Requires proficiency in a programming language such as Python, R, or MATLAB.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**DS 5230. Unsupervised Machine Learning and Data Mining. (4 Hours)**

Introduces unsupervised machine learning and data mining, which is the process of discovering and summarizing patterns from large amounts of data, without examples of data with a known outcome of interest. Offers a broad view of models and algorithms for unsupervised data exploration. Discusses the methodological foundations behind the models and the algorithms, as well as issues of practical implementation and use, and techniques for assessing the performance. Includes a term project involving programming and/or work with real-life data sets. Requires proficiency in a programming language such as Python, R, or MATLAB.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**DS 5500. Data Science Capstone. (4 Hours)**

Offers students a capstone opportunity to practice data science skills learned in previous courses and to build a portfolio. Students practice visualization, data wrangling, and machine learning skills by applying them to semester-long term projects on real-world data. Students may either propose their own projects or choose from a selection of industry options. Emphasizes the overall data science process, including identification of the scientific problem, selection of appropriate machine learning methods, and visualization and communication of results. Lectures may include additional topics, including visualization, communication, and data science ethics.

**Prerequisite(s):** (CS 5800 with a minimum grade of C- or EECE 7205 with a minimum grade of C-); DS 5110 with a minimum grade of C- ; DS 5220 with a minimum grade of C- ; DS 5230 with a minimum grade of C-

**DS 5983. Topics in Data Science. (4 Hours)**

Offers special topics in data science based on the interest and expertise of the faculty member conducting the course. May be repeated once.

**DS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DS 7990. Thesis. (4 Hours)**

Offers selected work with the agreement of a project supervisor. May be repeated once.

**DS 7995. Project. (1-4 Hours)**

Offers students an opportunity to participate in a direct data science project under the supervision of a faculty member. May be repeated once for a total of 8 credits.

**DS 8982. Readings. (1-8 Hours)**

Offers selected readings under the supervision of a faculty member. May be repeated without limit.

## Deaf Studies (DEAF)

**DEAF 1500. Deaf People in Society. (4 Hours)**

Focuses on Deaf communities as linguistic and cultural minorities. Topics include perspectives on Deaf communities; attitudes toward Deaf people and sign languages, technology, and communication; the contributions of Deaf people to society; professional and social organizations of and for Deaf people; Deaf clubs as a locus of Deaf culture; communication issues; perspectives on legislation affecting the Deaf Community; legislative and political concerns of the Deaf Community; and the impact of educational options for Deaf children. Also covers the diverse intersectional identities comprising the American Deaf Community due to language use (multilingual), race, gender, class, and multicultural experiences. Discusses the impact of autism, racism, and many other -isms.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**DEAF 1550. Dynamics of the Deaf/Blind Community: Culture, History, and Communication. (4 Hours)**

Explores the multidimensional aspects of the Deaf/Blind community, culture, communication, and history (dynamics of how society has handled individuals who are Deaf/Blind). Topics are studied from the Deaf/Blind perspective and include oppression and its power structures; empowerment vs. "rescue or fix it"; the loss of sight and its impact on communication; and learning about empathy and the courage of vulnerability. Explores Deaf/Blind culture and the grieving process as an ongoing component of life; different types of Deaf/Blindness and diverse styles of communication; and mobility issues and maintaining independence. A brief introduction to sighted guide techniques and technology available.

**Prerequisite(s):** AMLS 1102 (may be taken concurrently) with a minimum grade of C-

**DEAF 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DEAF 2500. Deaf History and Culture. (4 Hours)**

Surveys the history and culture of the American Deaf community and Deaf people in the Western world. Focuses on educational, political, and technological forces and events that have positively and negatively affected the American Deaf community. Focuses on the American Deaf community as a linguistic and cultural minority. Also examines contemporary values and factors that shape and define the diverse American Deaf community and compares and contrasts American Deaf cultural values with those of American society in general.

**Prerequisite(s):** DEAF 1500 with a minimum grade of D

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**DEAF 2700. ASL Linguistics. (4 Hours)**

Introduces the basic issues in linguistics by examining the structural properties of American Sign Language. Includes phonology (formational properties of signs); morphology (word formation, rules, derivation, inflection, complex verbs, classifiers, and verb modulations); semantics (the meaning structure of signs); and syntax (the structure of ASL utterances in terms of old vs. new information and the structure of ASL narratives). Examines sociolinguistic variation of ASL usage (such as region, age, and Black ASL), as well as language attitudes and change over time.

**Prerequisite(s):** (LING 1150 with a minimum grade of D- or ENGL 1150 with a minimum grade of D- ); (ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C ); AMSL 1102 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**DEAF 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DEAF 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DEAF 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Digital Media - CPS (DGM)****DGM 6105. Visual Communications Foundation. (4 Hours)**

Introduces the basic principles and concepts inherent in visual language systems. Covers fundamentals such as visual perception, composition, spatial relationships, color, form, repetition, texture, structure, abstraction, and figure-ground relationships. Student projects focus on visual problem solving with an emphasis on understanding of context, content, and the development of original forms.

**DGM 6108. Programming Foundations for Digital Media. (4 Hours)**

Offers students an opportunity to learn the fundamentals of programming in a multimedia environment. Emphasizes planning and production for interactive digital media. Using a scripting language as a base, covers how scripting relates to design and programming fundamentals that link logic to action. Topics include graphical user interfaces; user interaction; and algorithmic manipulation of text, graphics, sound, and video.

**Corequisite(s):** DGM 6109

**DGM 6109. Lab for DGM 6108. (2 Hours)**

Accompanies DGM 6108. Covers topics from the lecture course through various tutorials and problem-solving exercises.

**Corequisite(s):** DGM 6108

**DGM 6122. Foundations of Digital Storytelling. (4 Hours)**

Introduces the fundamentals of character and story development through practical applications in a variety of digital media, from text and storyboarding to sound, moving image, and interactive environments. Offers students an opportunity to become familiar with narrative sequencing and story development, experience the critical role of narrative in linear media, and apply these skills in nonlinear and experimental forms. Students work both individually and collaboratively to develop projects that explore creative storytelling.

**Prerequisite(s):** DGM 6105 with a minimum grade of C- ; DGM 6501 with a minimum grade of C-

**DGM 6140. Sound Design. (4 Hours)**

Explores the history, theory, and practice of sound design, the creation of aural environments, special effects, dialogue, and music for a variety of traditional and digital media, including film, TV/video, animation, theatre, radio, interactive games, and the Internet. Films such as *The Matrix*, *Citizen Kane*, and *Star Wars* serve as the basis for developing a core knowledge of sound design concepts, particularly the development of critical listening skills. Topics cover “spotting,” digital audio editing and recording, sample libraries, aesthetics of design, music composition, script interpretation, critical listening, professional collaboration, sound and music technology, digital audio production, and production organization. Offers students an opportunity to master core skills, enabling them to communicate effectively with directors, producers, and/or creative artists in the media and entertainment industries.

**DGM 6145. Information Technology and Creative Practice. (4 Hours)**

Explores interdisciplinary methodologies that promote creativity and stimulate innovative thinking. Information technology (IT) has formed a powerful alliance with art and design to establish the existing new domain of information technology and creative practices (ITCP). The result is an astonishing variety of significant cultural and economic forms ranging from innovative product designs to interactive art installations. Uses case studies and emphasizes the design, planning, and implementation of innovative prototypes.

**DGM 6168. Usability and Human Interaction. (4 Hours)**

Surveys the theory and practice of human-computer interaction and the development of user interfaces. Through both analysis and design projects, students have an opportunity to learn cutting-edge approaches to usability research and evaluation, testing methods, and how to design systems that meet end-user needs. Topics covered include behavioral and cognitive foundations of interaction design, principles of good design for interaction, basic user research techniques, and the process of user-centered design.

**DGM 6217. Typography for Interactivity. (4 Hours)**

Explores the basic principles of typographic design, particularly as applied to screen-based media. Topics include screen legibility and resolution, hierarchy and scale, and typographic form and style.

**Prerequisite(s):** DGM 6105 with a minimum grade of C-

**DGM 6230. Digital Media Entrepreneurship. (4 Hours)**

Focuses on the personal characteristics necessary to become a successful entrepreneur, as well as on the processes of evaluating an idea, assessing the market, and implementing a new venture, whether inside an organization or as an independent startup. Teaching methods include case study, guest speakers with entrepreneurial experience, lectures, and team projects that develop feasible business plans. Offers students an opportunity to evaluate their potential as entrepreneurs by learning how to identify and evaluate business opportunities, develop a business concept and marketing plan, assess and obtain the required resources, manage the growth of new ventures, and plan for exit strategies.

**Prerequisite(s):** DGM 6280 with a minimum grade of C-

**DGM 6268. Usable Design for Mobile Digital Media. (4 Hours)**

Offers students an opportunity to apply the user-centered, human-computer interaction (HCI) skills covered in DGM 6168 to mobile digital media experiences such as game, entertainment, and social media applications. Considers digital media design, aesthetics, and user behavior in mobile-based environments in the creation of a satisfying and engaging experience. Offers students an opportunity to understand best design practices on a mobile platform by applying HCI methods such as iterative design and the evaluative methods of heuristic evaluation and play testing.

**Prerequisite(s):** DGM 6168 with a minimum grade of C-

**DGM 6279. Project Management for Digital Media. (4 Hours)**

Introduces the project management life cycle for technology-based products and applications. Beginning with project initiation and assembling a team, offers students an opportunity to apply project management principles to all aspects of planning and managing a project, including scheduling and budgeting. Major topics include managing a team, including setting goals for creatives; managing assets; documentation; deadlines and client expectations; and balancing continuous improvement and rapid prototyping against the need to manage the scope of work.

**DGM 6280. Managing for Digital Media. (4 Hours)**

Surveys evolving best practices in creative industry management. Begins with the recognition that managing in an environment of innovation and creative media requires a radical rethinking of traditional managerial paradigms. Agile response to technological change requires strategic alternatives in company goals, priorities, and direction. Intellectual content and creativity are difficult to value within classic financial models. New devices and social networks demand responsive action in internal and external communications. Correctly valuing the performance of highly creative people can be key in maintaining or gaining a leadership position. Uses case studies, presentations, and team-based analysis to examine these challenges and discuss effective responses.

**DGM 6285. Interactive Marketing Fundamentals. (4 Hours)**

Introduces the exploration of messaging in current and evolving media outlets, the digital marketing mix, the growing promise of mobility, and the possibilities and pitfalls of marketing in social media. Marketing has been deeply challenged by the move from traditional to digital channels, as print and TV give way to Web sites and mobile devices as primary centers of information and entertainment. Explores Web analytics, in particular search engine marketing (SEM) and search engine optimization (SEO).

**DGM 6290. Social Media and Brand Strategy Implementation. (4 Hours)**

Offers students an opportunity to develop the context for working with marketing professionals to implement strategy in a variety of social media, from blogs to social networking sites, and from game worlds to content communities. Social media environments have become a prime target for product and personal marketing, advertising, and supporting a brand image. But their differences from passive media and even standard websites have made it more difficult to apply traditional thinking to these digital media channels. Utilizes lectures, research, projects, and case studies.

**DGM 6308. Intermediate Programming for Digital Media. (4 Hours)**

Offers students an opportunity to extend the basic proficiency in scripting languages gained in DMG 6108 to more sophisticated programming tasks using an industry-standard scripting language such as JavaScript. Covers the use of arrays and objects to structure data and apply object-oriented and event-driven programming principles to create sophisticated interactivity.

**Prerequisite(s):** DGM 6108 with a minimum grade of C- or DGM 6501 (may be taken concurrently) with a minimum grade of C-

**DGM 6317. Screen-Based Publication Design. (4 Hours)**

Introduces the theory and practice of designing books, magazines, and interactive hybrid narratives for touch screens. Offers students an opportunity to become familiar with grids, style sheets and templates, and output to a variety of e-publishing tools as they explore the differences in designing content for the Web, tablets, and smartphones.

**DGM 6322. Advanced Digital Storytelling. (4 Hours)**

Builds on concepts introduced in DGM 6122. Explores the ideation and production of more complex, nonlinear interactive narratives. Working intensively in a team setting, offers students an opportunity to explore ways to further integrate a variety of narrative elements into immersive experiences.

**Prerequisite(s):** DGM 6122 with a minimum grade of C-

**DGM 6400. Game Design Fundamentals. (4 Hours)**

Provides the foundation for all of the other courses in the graduate specialization and/or certificate in game design. Offers students an opportunity to learn the basic principles of game design through the creation of board and card games, and through video-game prototyping. Also offers an opportunity to develop skills, including graphic and written communication, rules logic, group dynamics, and basic programming logic.

**DGM 6403. Game Engine Fundamentals. (4 Hours)**

Offers students an opportunity to apply their prior experience in DGM 6400 to multiplatform game development and rapid prototyping using an industry-standard game design engine. Game engines provide quick-start platforms and industry-standard solutions for developing video games.

**Prerequisite(s):** DGM 6400 with a minimum grade of C

**DGM 6405. Game Development. (4 Hours)**

Introduces video game programming using a game engine. Building on their work from DGM 6400, students have an opportunity to create single-player computer games using industry-standard scripting languages. Projects focus on sound design, two-dimensional design and animation, or three-dimensional design and animation. Students can develop projects as individuals or as part of a team.

**Prerequisite(s):** DGM 6403 with a minimum grade of C-

**DGM 6410. Game Design Technology Lab. (4 Hours)**

Offers students an opportunity to explore recent technological advances in game design, including networked multiplayer gaming, 3D gaming, and alternative user interfaces such as cameras and motion/location-sensing devices. Student teams are encouraged to round out their game-design portfolios by developing a sophisticated videogame demo that focuses on a specific theme and technology.

**Prerequisite(s):** DGM 6405 with a minimum grade of C-

**DGM 6420. Game Workshop. (1 Hour)**

Requires teams to work collaboratively to develop the basics of several board games or card games.

**DGM 6430. Screenwriting: Linear and Interactive. (4 Hours)**

Introduces and builds on basic elements of traditional scriptwriting. Offers students an opportunity to develop their creative writing skills by developing a screenplay for either a film/video production or an interactive/immersive project. Emphasizes dialogue, dynamic role-playing, story generation, and character development for actors and animated characters. Requires proficiency in English or a TOEFL writing score of 27 or above.

**DGM 6435. Digital Video Production. (4 Hours)**

Using digital video cameras, students are introduced to field production skills and basic content editing. Students are encouraged to implement and experiment with ideas developed in DGM 6122 as they complete short videos. Through hands-on practice and discussion, as well as the viewing of classic documentary and fiction film/video examples, students have an opportunity to further explore composition of the frame and meanings produced from inter-shot and sequence relationships.

**Prerequisite(s):** DGM 6506 (may be taken concurrently) with a minimum grade of C-

**DGM 6440. Editing in the Digital Studio. (4 Hours)**

Uses virtual studio spaces to introduce and develop student comfort with non-linear digital editing. Offers students an opportunity to understand the basic principles of composition, pacing, titling, timecodes and video effects. Working with their own material, existing video clips, animations, still images and audio feeds, students are encouraged to experiment with different styles, methods, and output to gain a comprehensive understanding of the medium. DGM 6506 or prior experience with digital video editing is strongly recommended.

**Prerequisite(s):** DGM 6435 with a minimum grade of C-

**DGM 6450. Animation Basics. (4 Hours)**

Explores the creative potential of animation. Exposes students to animation processes and techniques through lectures, demonstrations, and hands-on assignments. Provides a historical survey of animation art. Emphasizes using the computer to creatively develop concepts while learning the fundamental skills of constructing images and forms. Students collaborate on projects during the first half of the course and work individually on final projects.

**Prerequisite(s):** DGM 6105 (may be taken concurrently) with a minimum grade of C-

**DGM 6451. Web Development. (4 Hours)**

Focuses on intermediate to advanced concepts and techniques for development of professional Web environments. Offers students an opportunity to explore different development strategies, including client-side interactions using AJAX libraries (such as JavaScript, PHP, and MySQL) compared with client/server methods, webpage presentation layer vs. interactive layer, and the use of WYSIWYG (what you see is what you get) tools vs. plain-text coding.

**Prerequisite(s):** DGM 6108 with a minimum grade of C- ; DGM 6521 with a minimum grade of C-

**DGM 6461. Interactive Information Design 1. (4 Hours)**

Focuses on the fundamental principles of interactive design to develop meaningful interactive experiences. Offers students an opportunity to develop skills in structuring and organizing information, recognizing and establishing content relationships, and building usable navigation. Explores a variety of tools and technologies to deliver varied media material for screen-based use.

**Prerequisite(s):** DGM 6168 (may be taken concurrently) with a minimum grade of C- or TCC 6120 (may be taken concurrently) with a minimum grade of C-

**DGM 6463. Interactive Information Design 2. (4 Hours)**

Builds on the content and explorations of DGM 6461. Explores complex information organization and delivery problems while seeking to advance the students' experience with interactive design and programming environments.

**Prerequisite(s):** DGM 6461 with a minimum grade of C- ; DGM 6217 with a minimum grade of C-

**DGM 6471. Designing Infographics. (4 Hours)**

Explores a variety of methods that help to translate raw data into accessible visual presentations that can inform, clarify, educate, and persuade. A powerful aspect of Internet technologies is how readily they provide access to information. However, that information often resides in opaque technical formats, making it hard to understand and disseminate.

**Prerequisite(s):** DGM 6461 with a minimum grade of C- ; DGM 6217 with a minimum grade of C-

**DGM 6501. Web Creation Boot Camp. (2 Hours)**

Offers students an opportunity to gain basic competency in the design and coding of an attractive, effective, static website. Covers basic web design technology, including webpage structure, markup languages (HTML and CSS), basic rules for image preparation, and site development and management using an industry-standard text editor. This course is an intensive workshop.

**DGM 6506. Introduction to Digital Video. (2 Hours)**

Uses industry-standard software to introduce editing and compression techniques critical for effective participation in digital video production and editing courses. Offers students an opportunity to become comfortable editing a short video for content, preparing it for posting on the Web, and/or including it in an interactive media project.

**DGM 6510. 3D Modeling. (4 Hours)**

Introduces the fundamentals of three-dimensional computer animation. Class lectures and demonstrations are followed by substantial hands-on exploration. Offers students an opportunity to gain fundamental skills for polygon modeling and UV surfacing. Projects progress from creating simple geometric objects to realistic organic characters.

**Prerequisite(s):** DGM 6505 (may be taken concurrently) with a minimum grade of C- ; DGM 6450 with a minimum grade of C-

**DGM 6515. Introduction to After Effects. (2 Hours)**

Introduces the creation and manipulation of motion graphics and time-based visual effects using the After Effects environment. Offers students an opportunity to acquire the basic knowledge required for DGM 6540.

**DGM 6516. Virtual and Augmented Reality (VR/AR). (2 Hours)**

Explores trends and technologies driving virtual reality and augmented reality (VR/AR) video production. Through a blend of class discussions and hands-on practice, offers students an opportunity to conceptualize, produce, and deliver high-quality immersive VR videos, apply AR in video production, and understand applications of this technology for a variety of fields.

**Prerequisite(s):** DGM 6506 with a minimum grade of C-

**DGM 6520. Lighting for the Camera. (4 Hours)**

Emphasizes essential lighting theory and techniques. Understanding lighting is the key to a professional photographic or video shoot. Topics include lighting equipment; lighting sources and arrangement; color temperature; lighting for indoor, outdoor, and location shooting; as well as the editorial use of lighting to create tone and communicate narrative. Offers students an opportunity to create projects in different lighting environments and for different purposes to experience a wide range of lighting problems and solutions.

**DGM 6521. Web Creation for Content Management Systems. (2 Hours)**

Expands on the foundations of web creation with an emphasis on developing for content management systems such as WordPress. Offers students an opportunity to work intensively to use web technologies to build on these open-source software models' core capabilities. Requires basic knowledge of cascading style sheets (CSS) and beginner knowledge of PHP.

**DGM 6525. Research Methods for Global User Experiences. (4 Hours)**

Focuses on a structured approach to user research methodology for the design of interactive applications. Emphasizes user research and interpretation for products and services that will be marketed to individuals spanning cultures with radically different customs and communication. Applies field methods such as interviewing, observation, and questionnaire design through the lens of intercultural psychology and communication patterns, cultural neutrality, and culture-centric design.

**Prerequisite(s):** DGM 6168 with a minimum grade of C-

**DGM 6530. Character Animation. (4 Hours)**

Provides an in-depth investigation of 3-D animation. Offers students an opportunity to continue development of realistic characters created in DGM 6510 and to develop intermediate skills for weight mapping and rigging, as well as midlevel proficiency with animation editors. Projects focus on creating animations that emphasize realistic deformation and movement.

**Prerequisite(s):** DGM 6450 with a minimum grade of C-

**DGM 6535. Rigging Principles and Techniques. (4 Hours)**

Offers animation students the opportunity to apply realistic motion effects to a complete, intuitive character rig. Convincing animation of 3D characters and objects requires rigging—the setup and scripting of a range of structural controls. Explores character preparation and motion control; kinematics; realistic motion effects, including textures such as fur and hair; and environmental elements, such as fluids, fire, and explosions.

**Prerequisite(s):** DGM 6530 with a minimum grade of C-

**DGM 6540. Compositing. (4 Hours)**

Investigates compositing and special FX techniques. Student teams have an opportunity to utilize green screen studio to capture live-action video footage that is seamlessly combined with computer-generated environments and characters that they create. Offers students an opportunity to develop original narratives that are suitable for exploring course objectives.

**Prerequisite(s):** DGM 6440 with a minimum grade of C- or DGM 6515 (may be taken concurrently) with a minimum grade of C-

**DGM 6545. Documentary and Nonfiction Production. (4 Hours)**

Offers students interested in documentary filmmaking an opportunity to learn the research, story structure, and production skills necessary to bring a nonfiction video narrative from preproduction through postproduction and refine their work from rough to final cut. Using scenes and examples from notable documentaries to inspire and illustrate technique, students research topics, find subjects, conduct interviews, practice techniques of cinema vérité and B-roll, and work with archival footage to complete one major nonfiction project.

**Prerequisite(s):** DGM 6440 with a minimum grade of C-

**DGM 6550. Search Engine Optimization: Strategy and Implementation. (4 Hours)**

Connects the search engine optimization (SEO) process to marketing and social media strategy by introducing students to the concepts behind consumer search behavior, search engine algorithms, and SEO analysis using tools such as Google Analytics. A website's frequency ranking in a content search critically impacts its visibility and, ultimately, viability. Seeks to provide foundational guidance on topics such as organic search tactics, website optimization, and keyword research and selection.

**Prerequisite(s):** DGM 6461 with a minimum grade of C- or DGM 6285 with a minimum grade of C-

**DGM 6890. Thesis Proposal Development. (2 Hours)**

Offers students an opportunity to understand thesis goals and process, with a view toward developing strong project ideas, an effective and realistic development path, and a well-written preliminary proposal.

**DGM 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**DGM 6983. Topics. (1-4 Hours)**

Offers students the opportunity to study, through research and experimentation, in a specified discipline. May be repeated up to four times.

**DGM 6995. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated up to five times.

**DGM 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**DGM 7980. Capstone. (6 Hours)**

Offers students an opportunity to demonstrate competency in core digital media topics and concentration-based learning outcomes through the development of a research-based project.

**DGM 7990. Thesis. (4-6 Hours)**

Offers students an opportunity to complete a digital media project, researched and proposed by the student and directed by one or more members of the faculty. The thesis project can be an individual endeavor or the result of a collaboration involving two or more students in the program.

**DGM 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers continuing thesis supervision by members of the department.

**Digital Transformation (DGTR)****DGTR 1001. Emerging Technologies in Digital Transformation. (4 Hours)**

Offers an overview of the key emerging sectors in digital transformation: cloud computing, blockchain, fintech, healthcare, IoT, IaaS, cybersecurity, drones, and immersive technologies (AR, VR, MR). Studies specific cases and examples to examine how each of these technologies contributes to the digital transformation of business.

**DGTR 1101. Mathematical Structures and Methods. (4 Hours)**

Introduces mathematical structures and methods that form the foundation of computer science. Examines structures such as sets, tuples, sequences, lists, trees, and graphs. Explores functions, relations, ordering, and equivalence relations, as well as inductive and recursive definitions of structures and functions. Covers principles of proof such as truth tables, inductive proof, basic logic, counting techniques, and arguments that are needed to estimate the size of sets, growth of functions, and space-time complexity of algorithms.

**Attribute(s):** NUpath Formal/Quant Reasoning

**DGTR 1110. Business Foundations and Digital Transformation. (4 Hours)**

Examines the structure and operation of businesses through the lens of digital transformation. Covers general business operations and practices and how these operations and practices have evolved within an increasingly digital-first workplace. Explores the internal elements of customer, strategy, and organization, as well as the external elements of competition, regulation, and market environment. Focuses specifically on digital transformation and the role of individual contributors to the organization. Offers students an opportunity to obtain context and understanding of economics, business operations, and other key business considerations from various global standpoints.

**DGTR 1700. Data Management Systems. (4 Hours)**

Explores how a wide range of enterprises around the world use information and information technology to create better-managed, more innovative, and successful organizations. Today's business leaders must have ready access to timely, accurate, and relevant information to manage effectively in the global economy. Offers students an opportunity to apply knowledge of data management systems using industry-standard cloud-based technology.

**DGTR 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**DGTR 2150. Applied Data Visualization. (4 Hours)**

Introduces the use of design, interaction, visualization techniques, and strategies to support the effective presentation and manipulation of business information, based on principles from art, design, psychology, and information science. Offers students an opportunity to learn how to choose appropriate methods for representing various kinds of business data to support analysis, decision making, and communication to organizational stakeholders. Students apply their knowledge of data visualization using industry-standard cloud-based technology, e.g., ServiceNow.

**DGTR 2199. Database Design and Management 1. (4 Hours)**

Covers the underlying principles and concepts of relational databases. Uses the reporting language SQL for creating and accessing data tables, indexing, arithmetic operations, loops, arrays, multiple table processing, I/O operations, data-type conversions, and views. Offers students an opportunity to use SQL to interrogate relational databases and design simple databases, applying their knowledge of relational databases using industry-standard cloud-based technology, e.g., ServiceNow.

**Prerequisite(s):** DGTR 1101 with a minimum grade of D-

**DGTR 2299. Data-Driven Decision Making 1. (4 Hours)**

Offers an in-depth focus on data-driven decision making in organizations. Uses solution-based case studies to examine the models, tools, techniques, and theory of data-driven decision making to improve the quality of business leadership decisions.

**DGTR 2330. Organizational Culture and Change. (4 Hours)**

Focuses on what drives the behaviors and actions of people in an organization. Explores topics such as motivation, influence, leadership, group dynamics, conflict, and other variables that impact organizational culture and change. Reviews key organizational behavior topics related to culture and change, including underlying theories and principles. Offers students an opportunity to analyze current cases that highlight practical application of the principles or underscore common themes or actions that impact culture and change in an organization.

**DGTR 2500. Digital Fluency in the AI-Enabled Enterprise. (4 Hours)**

Examines digital fluency for organizational leaders, including the syntax knowledge, sociolinguistic sensibility, and strategic expertise that a person gains and demonstrates in their use of information resources. Offers students an opportunity to improve their own digital fluency in the context of enhancing critical thinking, design thinking, and systems thinking.

**Attribute(s):** NUpath Natural/Designed World

**DGTR 2501. Information Technology Project Management. (4 Hours)**

Covers tools and techniques used to manage information technology projects. Topics include project planning, scheduling, budgeting, and project management tools. Discusses all phases of IT projects, from proposal evaluation through postimplementation reviews. Students plan and develop a project that offers a practical application of the topics covered in class. Offers students an opportunity to apply their knowledge of IT project management using industry-standard cloud-based technology, e.g., ServiceNow.

**DGTR 2700. Foundations of Software Engineering. (4 Hours)**

Covers the foundations of software engineering, including software development life cycle models (e.g., waterfall, spiral, agile); requirements analysis; user-centered design; software design principles and patterns; testing (functional testing, structural testing, testing strategies); code refactoring and debugging; software architecture and design; and integration and deployment.

**DGTR 2822. Networks and Platform Technologies. (4 Hours)**

Introduces the fundamentals of computer networks. Covers network architectures, topologies, and protocols; layering concepts (ISO/OSI, TCP/IP reference models); communication paradigms (point-to-point vs. multicast/broadcast, connectionless vs. connection oriented); and networking APIs (sockets). Also covers the construction of distributed programs, with an emphasis on high-level protocols and distributed state sharing. Topics include design patterns, transactions, performance trade-offs, security implications, and reliability. Uses examples from real networks (TCP/IP, Ethernet, 802.11) and distributed systems (web, BitTorrent, DNS) to reinforce concepts. Offers students an opportunity to apply their knowledge of networks and platform technologies using industry-standard cloud-based technology training, e.g., ServiceNow.

**DGTR 2850. Intensive Foundations of Computer Science and Programming 1. (4 Hours)**

Introduces the fundamental ideas of computing and programming principles. Discusses a systematic approach to word problems, including analytic reading, synthesis, goal setting, planning, plan execution, and testing. Presents several models of computing, beginning with functional program design. Explores the Python programming language, its syntax, mathematical functionality, and suitability for data analysis applications.

**Prerequisite(s):** DGTR 1101 with a minimum grade of D-

**DGTR 2900. Digital Transformation and Decision Making. (4 Hours)**

Introduces the fundamentals of individual reasoning and decision making in the context of digital transformation. Covers factors that influence decision making, such as personality, emotions and emotional intelligence, perception, and attribution. Explores the impact of situational variables on human behavior and decision making. Offers students an opportunity to apply these concepts to the study of human logic, decision-making processes, and common decision-making biases. Addresses the role of these topics in enabling organizational resilience.

**DGTR 2901. Risk and Resilience in Digital Transformation Contexts. (4 Hours)**

Introduces systems thinking and the ability to appreciate and plan for dynamic, constantly changing situations and environments. Risk management is a core theme in digitally driven organizations as the impact of disaster scenarios can wreak havoc. Reviews assessment strategies for business operations, as well as mitigation strategies in case of disruption. Examines how resilience, a skill set that has individual, organizational, and societal impacts, is established and maintained both by individuals and by organizations.

**DGTR 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**DGTR 3000. Innovation and Design in Customer Experience. (4 Hours)**

Introduces innovative processes, including design thinking, for removing constraints and biases, extending intellectual curiosity, and enhancing customer and user experience. Explores product research as well as product development and prototyping.

**Prerequisite(s):** DGTR 1001 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**DGTR 3100. Intensive Foundations of Computer Science and Programming 2. (4 Hours)**

Covers more advanced topics in computing and programming principles. Explores advanced Python programming and design principles. Engages students in an extensive programming task that should result in the creation of a test suite. Explores pair programming and public code review techniques, as found in the industry today. Offers students an opportunity to apply their knowledge of computer systems and programming using industry-standard cloud-based technology, e.g., ServiceNow.

**Prerequisite(s):** DGTR 1101 with a minimum grade of D- ; DGTR 2850 with a minimum grade of D-

**DGTR 3199. Database Design and Management 2. (4 Hours)**

Studies the design of a database for use in a relational database management system. Uses the entity-relationship model and normalization in problems. Discusses relational algebra and SQL. Covers advanced topics, including triggers, stored procedures, indexing, elementary query optimization, and fundamentals of concurrency and recovery. Offers students an opportunity to implement a database schema and short application programs on one or more commercial relational database management systems, applying their knowledge of databases using industry-standard cloud-based technology, e.g., ServiceNow.

**Prerequisite(s):** DGTR 2199 with a minimum grade of D-

**DGTR 3299. Data-Driven Decision Making 2. (4 Hours)**

Continues DGTR 2299. Explores key areas in data-driven decision making in leadership and organizations through the utilization of case studies and applied hands-on projects. Examines core issues around quality of data, data analytic approaches, techniques, and measuring and managing of data in a customer-centric organization. Studies this topic through the lens of various business metrics and applied tools in the market.

**Prerequisite(s):** DGTR 2299 with a minimum grade of D-

**DGTR 3310. Predictive Analytics. (4 Hours)**

Introduces the end-to-end data-driven statistical modeling and predictive modeling approach with applications and case studies. Includes all the data and modeling steps in a full modeling cycle; exploratory data analysis and data cleansing for outlier imputation and data normalization; commonly applied modeling techniques such as classification, linear regression, and logistic regression; and modeling steps such as model training, validation, and testing.

**Prerequisite(s):** DGTR 1101 with a minimum grade of D-

**DGTR 3500. Cybersecurity in Digital Transformation. (4 Hours)**

Studies cybersecurity threats facing organizational information systems and digital assets. Examines an organization's legal and ethical responsibilities regarding data protection and security. Explores cyberthreats and adversaries, access control mechanisms, encryption, and hashing. Also covers the SecOps function, the security operations center, incident management, and digital forensics. Examines approaches and frameworks for evaluating the cyber-risks facing organizations, as well as actions that can be taken and mechanisms that can be employed to strengthen the security of organizational data and computing systems.

**Prerequisite(s):** IS 1300 (may be taken concurrently) with a minimum grade of D- or PHIL 1300 (may be taken concurrently) with a minimum grade of D-

**DGTR 3550. Data Analytics in Digital Transformation. (4 Hours)**

Introduces the subject of data analytics. Examines how raw data is collected, stored, cleansed, and interrogated in order to contribute to the needs of organizations. Covers four main areas of data analytics: descriptive, diagnostic, predictive, and prescriptive. Applies industry-standard software and Python packages commonly used for data analytics, encompassing basic graphical, numerical, and statistical tools. Offers students an opportunity to apply their knowledge of data analytics using industry-standard cloud-based technology, e.g., ServiceNow.

**Prerequisite(s):** DGTR 1101 with a minimum grade of D-

**DGTR 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**DGTR 4000. Implementing Data Science. (4 Hours)**

Studies how to approach data analysis problems in a systematic manner and how to design data analysis pipelines, as well as how to implement them at scale in the context of real-world problems. Data science is at the intersection of statistics, machine learning, and software development. Data analysis problems are solved in a series of datacentric steps: data acquisition, data cleaning, data transformation, data modeling, and data visualization.

**Prerequisite(s):** DGTR 3310 with a minimum grade of D-

**DGTR 4100. Information Technology Service Management. (4 Hours)**

Examines the frameworks and strategic approaches for the life cycle management of IT products—including planning, design, development, and delivery—and for improving IT services from a higher-level enterprise perspective—including the management of disparate servers throughout the organization. Covers the strategic management of IT infrastructure, agile IT service, configuration, data and information security, and disaster recovery in the context of cloud computing. Explores the strategies to provide value to customers. Offers students an opportunity to apply their knowledge of IT service management using industry-standard cloud-based technology, e.g., ServiceNow.

**Prerequisite(s):** DGTR 1110 with a minimum grade of D-

**DGTR 4320. Voice of the Customer. (4 Hours)**

Introduces students to the marketing function and the imperative of listening to the voice of the customer, or VOC. Explores the needs of modern customers for business-to-business (B2B) as well as business-to-consumer (B2C) products and services and how they influence operations in successful companies. Topics include principles of marketing, market research, marketing communications, and customer loyalty.

**Prerequisite(s):** DGTR 1110 with a minimum grade of D-

**DGTR 4450. Strategy Consulting. (4 Hours)**

Introduces the models, skills, and emerging trends in the field of strategic management consulting. Explores the global spectrum of consulting and reviews multiple consulting models and practices to compare and contrast the strengths and differences. Examines the evolution of the practice that is increasingly data driven and digital, with new technologies and AI innovations that drive process and strategy. Also explores the roles of influence and value creation. Offers students a hands-on and immersive opportunity to step into the role of a consultant, taking on real-world organizational challenges to develop critical-thinking skills; using analytical and systems-thinking approaches and tools to solve business problems; and developing skills for building and exercising influence within an organization and externally with clients.

**Prerequisite(s):** DGTR 1110 with a minimum grade of D- ; ENGW 3302 with a minimum grade of D-

**DGTR 4580. Advanced Information Technology Service Management. (4 Hours)**

Explores the IT Infrastructure Library, a best-practice framework for IT service management, which describes how IT resources should be best organized and managed to optimize organization goals. ITIL is independent of technology or business. Covers the fundamentals of ITIL: service strategy, service design, service transition, service operation, and continual service improvement. Offers students an opportunity to apply knowledge of data management systems using industry-standard cloud-based technology (e.g., ServiceNow training), as well as the opportunity to gain certification in ITIL.

**Prerequisite(s):** DGTR 4100 with a minimum grade of D-

**DGTR 4720. Leadership and Personal Branding. (4 Hours)**

Introduces the behavioral and communication skills needed to define and establish one's place in the professional world and the fundamentals of leadership in a business environment. Emphasizes the foundational skills needed to be effective and influential leaders, whether with or without formal power. Offers students an opportunity to clarify their skill sets, values, and career aspirations, as well as to take action to build a successful personal brand for their professional advancement.

**Prerequisite(s):** DGTR 1001 with a minimum grade of D- ; DGTR 1110 with a minimum grade of D-

**DGTR 4910. Experiential Capstone. (4 Hours)**

Offers students an opportunity, guided by the capstone faculty member, to apply their conceptual awareness and skills through a 15-week experiential, work-integrated project. Focuses on aligning a work-based project demonstrating a high level of technical skills and knowledge and reflecting mastery of the concepts covered by the courses for that academic year. The capstone focus can include an area of digital transformation covered throughout the program and might include a technical or data-driven challenge and solution, a process improvement challenge, a management challenge or opportunity, etc. Emphasizes independent research, in-depth analysis in digital technology solutions, and applied work-integrated skill development. Requires strong communication of findings and logic of ideas in a professional format as well as application of project management principles to work. May be repeated two times.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**DGTR 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**Earth and Environmental Sciences (ENVR)****ENVR 1000. Marine and Environmental Sciences at Northeastern. (1 Hour)**

Intended for first-year students in the College of Science. Introduces students to liberal arts; familiarizes them with their major; develops the academic skills necessary to succeed (analytical ability and critical thinking); provides grounding in the culture and values of the University community; and helps to develop interpersonal skills—in short, familiarizes students with all skills needed to become a successful university student.

**ENVR 1101. Environmental Science. (4 Hours)**

Focuses on the complex array of topics that collectively form the discipline of environmental science. Emphasizes the problems facing today's natural, human-managed, and coupled human/natural ecosystems and the solutions to those problems. Studies the human dimensions of environmental science, including culture, politics, worldviews, ethics, and economics, particularly within the context of global climate change. Offers students an opportunity to learn to analyze data as a means of exploring relationships among societal and ecological drivers affecting economic, ecological, and socioeconomic stability; to learn how the scientific method is used to separate fact and data from opinion; and to apply these methods to explore the causes and solutions to global climate change.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**ENVR 1110. Global Climate Change. (4 Hours)**

Analyzes Earth's modern climate system and natural climate change over Earth's 4.5-billion-year history. Examines ongoing and future climate change. Includes expected impacts of the predicted climate changes as well as mitigation and adaptation options.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**ENVR 1120. Oceans and Coasts. (4 Hours)**

Explores the marine and coastal realm and the problems that arise from the human-marine relationship. Begins by studying the history of the ocean and ends with how to create a more sustainable marine world. Topics covered include ocean and estuarine circulation, climate change and ocean response, and the plant and animal life thriving in different parts of the ocean. Includes reading and analyzing the scientific literature, developing and presenting research projects, and group work.

**Attribute(s):** NUpath Natural/Designed World

**ENVR 1200. Dynamic Earth. (4 Hours)**

Offers a systematic study of the materials and systems comprising the earth. Emphasizes the processes that form, transport, alter, and destroy rocks, as well as the nature and development of landscape. Plate tectonics theory is introduced as a guiding paradigm in geology.

**Attribute(s):** NUpath Natural/Designed World

**ENVR 1201. Lab for ENVR 1200. (1 Hour)**

Accompanies ENVR 1200. Covers exercises pertaining to mineral and rock identification and topographic and geologic map interpretation. Required for environmental geology and geology majors.

**Prerequisite(s):** ENVR 1200 (may be taken concurrently) with a minimum grade of D-

**ENVR 1400. Foundations in Environmental and Sustainability Sciences. (4 Hours)**

Presents a series of lectures and case studies focused on the problems facing today's natural, human-managed, and coupled human/natural ecosystems. Integrates the underlying science with the human dimensions of environmental challenges. These include an understanding of the basic chemistry, physics, and ecology of environmental change and how this science is informed and altered by culture, politics, worldviews, ethics, and economics. Examines quantitative techniques to analyze data as a means of exploring relationships among societal and ecological drivers affecting economic, ecological, and socioeconomic stability. Studies how the scientific method is used to separate facts and data from opinion and applies these methods to explore the causes and solutions to global climate change and other environmental challenges.

**Corequisite(s):** ENVR 1401

**Attribute(s):** NUpath Natural/Designed World

**ENVR 1401. Lab for ENVR 1400. (1 Hour)**

Accompanies ENVR 1400. Offers supervised lab/discussion sessions for students to develop the tools needed to tackle environmental problem solving at the interface of human and natural systems.

**Corequisite(s):** ENVR 1400

**ENVR 1500. Introduction to Environmental, Social, and Biological Data. (4 Hours)**

Introduces the fundamental concepts in the fields of environmental, social, and biological science. Studies the expertise needed in each discipline to organize and manage data in sustainability science. The first half of the course covers data collection relevant to pressing issues in sustainability, database organization, coding, and finding errors in data sets. The second half of the course covers basic principles in the statistical analysis of data sets used in conservation and sustainability, including simulating data, machine learning, and errors in analysis. Offers hands-on experience through students' own data collection projects. Appropriate for students interested in biology, marine biology, environmental science, and ecology and evolutionary biology. Designed to prepare students for co-ops and upper-level classes in these fields.

**Corequisite(s):** ENVR 1501

**ENVR 1501. Lab for ENVR 1500. (1 Hour)**

Accompanies ENVR 1500. Offers supervised lab sessions demonstrating how topics covered in the lectures can be addressed using a variety of platforms, including Excel, R, and Python.

**Corequisite(s):** ENVR 1500

**Attribute(s):** NUpath Analyzing/Using Data

**ENVR 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENVR 2118. Ocean Literacies. (4 Hours)**

Uses UNESCO's Seven Principles of Ocean Literacy to explore how scientific and technological understandings of the ocean inform cultural production—including novels, films, maps, and philosophy—and intersect with gender, race, and class. Offers students an opportunity to deepen understandings of key topics in marine science, develop skills in cultural and historical analysis, and collaborate with an external partner on a science and storytelling project.

**ENVR 2200. Earth's Changing Cycles. (4 Hours)**

Introduces the biological, chemical, and physical interactions that shape our environment and how industrial emission of gases and black carbon, the use of fertilizers and plastics, and the expansion of cities are altering Earth's systems at rates unprecedented in the recent geological record. Offers students an opportunity to build a fundamental understanding of major issues in environmental science, including climate change, eutrophication, loss of biodiversity, and urbanization. Considers how we might build a more sustainable future.

**Attribute(s):** NUpath Natural/Designed World

**ENVR 2310. Earth Materials. (4 Hours)**

Describes the physical and chemical characteristics of common rock-forming minerals and geologic processes that form rock and soils in the igneous, sedimentary, and metamorphic environments. Focuses on commonly encountered minerals, soil, and rock types and how these are used to interpret past and present earth processes. This is a writing-intensive course with a required term paper.

**Prerequisite(s):** (ENVR 1101 with a minimum grade of D- or ENVR 1200 with a minimum grade of D- or ENVR 1400 with a minimum grade of D-); (ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C )

**Corequisite(s):** ENVR 2311

**Attribute(s):** NUpath Writing Intensive

**ENVR 2311. Lab for ENVR 2310. (1 Hour)**

Accompanies ENVR 2310. Cover topics from the course through various experiments.

**Corequisite(s):** ENVR 2310

**ENVR 2340. Earth Landforms and Processes. (4 Hours)**

Focuses on the origin and evolution of landscape features by processes operating at or near the earth's surface. Exercises introduce interpretation of air photos, topographic maps, remotely sensed data, and digital elevation models.

**Prerequisite(s):** ENVR 1200 with a minimum grade of D-

**Corequisite(s):** ENVR 2341

**ENVR 2341. Lab for ENVR 2340. (1 Hour)**

Accompanies ENVR 2340. Covers topics from the course through various experiments.

**Corequisite(s):** ENVR 2340

**ENVR 2401. Food Justice and Community Development. (4 Hours)**

Uncovers and examines the key dilemmas of the food system in the United States today using readings, media, discussion, service-learning, and field trips. Working from the foundations of environmental justice and community development, covers production, access, distribution, and key stakeholders from producers to retailers, workers, and consumers. Considers what justice-related issues face stakeholders within the food system in the United States; what policies have most impacted the workforce in the American food system; and what the opportunities and leverage points are for change in improving justice outcomes in this system.

**Attribute(s):** NUpath Integration Experience

**ENVR 2500. Biostatistics. (4 Hours)**

Presents an overview of key statistical concepts and approaches for analyzing biological data. Focuses on the mathematical foundations of statistics. Topics include probability, probability distributions, experimental design, as well as statistical inference via point or interval estimation and hypothesis testing. Discusses classic parametric and nonparametric statistical tests for one or more population(s). Emphasizes the appropriateness of each test based on its assumptions, statistical power, and the structure of the data.

**Corequisite(s):** ENVR 2501, ENVR 2502

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**ENVR 2501. Lab for ENVR 2500. (1 Hour)**

Accompanies ENVR 2500. Offers supervised lab sessions demonstrating how topics covered in the lectures can be addressed in the R programming environment.

**Corequisite(s):** ENVR 2500

**ENVR 2502. Recitation for ENVR 2500. (0 Hours)**

Accompanies ENVR 2500 and ENVR 2501. Covers various topics from the course. Offers students an opportunity to work interactively with instructors and other students to learn and apply the knowledge acquired in lecture and lab.

**Corequisite(s):** ENVR 2500, ENVR 2501

**ENVR 2515. Sustainable Development. (4 Hours)**

Focuses on the principles and practice of sustainable development, both as a way of looking at the interconnected world and an overarching framework for promoting economic development, social inclusion, and environmental stewardship. Students will study decades of local and global efforts aimed at developing economies, eradicating hunger and disease, and restoring and sustaining ecosystems for a large, and growing, population living on an increasingly altered planet and facing a changing climate. Along with lectures and discussions on core concepts, students will critically dissect the toughest questions and challenges of sustainable development through an online class blog and semester-long group projects.

**Prerequisite(s):** ENVR 1101 (may be taken concurrently) with a minimum grade of D- or ENVR 1400 (may be taken concurrently) with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**ENVR 2900. Special Topics in Environmental Studies. (4 Hours)**

Studies various topics on environmental issues. May be repeated once.

**ENVR 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENVR 2991. Research in Marine and Environmental Sciences. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated seven times.

**ENVR 3125. Global Oceanic Change. (4 Hours)**

Explores major changes in physical, biological, and chemical properties of the ocean over geological and human timescales. Includes origin and early evolution of the oceans; sea-level change; global warming; ocean acidification; the role of plate tectonics in driving long-term oceanic change; the role of atmospheric carbon dioxide in driving short-term oceanic change; tipping points in the oceans; snowball earth theory; marine pollution; oil exploration; and social, economic, and political implications of global oceanic change. Themes include differentiating drivers of change across multiple temporal and spatial scales; evaluating change from different and sometimes conflicting perspectives (social, economic, political, environmental); differentiating local and global change; and establishing linkages between physical, chemical, and biological processes in the ocean. Requires prior completion of one laboratory science course or permission of instructor.

**Attribute(s):** NUpath Natural/Designed World

**ENVR 3150. Food Security and Sustainability. (4 Hours)**

Discusses the science of sustainable agriculture, fisheries, and aquaculture. Examines the issues related to nutrition and hunger, food safety, and food production in the face of a changing climate with a scientific lens. Using the FAO Global Food Security and Strategy document and other peer-reviewed literature, compares the food issues in the United States with those in the developing world, including sub-Saharan Africa and Southeast Asia. Explores the many issues related to food production and environmental sustainability—including fertilizer use, GMOs, and pollution—and local examples of sustainable food production. Discusses the ways in which we can potentially remedy many of the issues involved in providing food for more than 7 billion people worldwide.

**Prerequisite(s):** EEMB 1101 with a minimum grade of D- or ENVR 1101 with a minimum grade of D- or ENVR 1110 with a minimum grade of D- or ENVR 1120 with a minimum grade of D- or ENVR 1200 with a minimum grade of D- or ENVR 1400 with a minimum grade of D- or SOCL 1246 with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World, NUpath Writing Intensive

**ENVR 3200. Water Resources. (4 Hours)**

Offers students who wish to work in the area of water resources an opportunity to understand the issues related to water's availability and behavior at the Earth's surface. Topics covered include (1) the hydrologic cycle, including global and regional patterns of water movement; (2) characteristics of surface and groundwater systems, including the linkage between streams, rivers, lakes, wetlands, groundwater, and the sea; (3) water management issues and regulations that have been enacted to control the use of water as a resource; (4) water quality measures for surface water and groundwater; and (5) examples of water use conflicts and emerging water issues. Case studies include examples from California, New England, New York, the southwestern United States, China, Africa, and the Middle East.

**ENVR 3300. Geographic Information Systems. (4 Hours)**

Studies how to use a geographic information system (GIS). Explores the practical application of GIS to support scientific and social inquiry, analysis, and decision making. Topics include spatial data collection; data accuracy and uncertainty; cartographic principles and data visualization; geographic analysis; and legal, economic, and ethical issues associated with using GIS. Investigates case studies from geology, environmental science, urban planning, architecture, social studies, and engineering. Provides extensive hands-on experience with a leading commercial GIS software package. Offers students an opportunity to conceive their own research problem that can be addressed using GIS and reach conclusions that are summarized in a professional report. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** EEMB 1101 with a minimum grade of D- or ENVR 1101 with a minimum grade of D- or ENVR 1200 with a minimum grade of D- or ENVR 1400 with a minimum grade of D- or ENVR 2200 with a minimum grade of D-

**Corequisite(s):** ENVR 3301

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Creative Express/Innov

**ENVR 3301. Lab for ENVR 3300. (1 Hour)**

Accompanies ENVR 3300. Covers topics from the course through various experiments.

**Corequisite(s):** ENVR 3300

**ENVR 3410. Environmental Geochemistry. (4 Hours)**

Offers students who wish to work in the geosciences or environmental science and engineering fields, including on the land, in freshwater, or the oceans, an opportunity to understand the geochemical principles that shape the natural and managed environment. Seeks to provide a context for understanding the natural elemental cycles and environmental problems through studies in atmospheric, terrestrial, freshwater, and marine geochemistry. Topics include fundamental geochemical principles; environmental mineralogy; organic and isotope geochemistry; the global carbon, nitrogen, and phosphorous cycles; atmospheric pollution; environmental photochemistry; and human-natural climate change feedbacks.

**Prerequisite(s):** CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1214 with a minimum grade of D-  
**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**ENVR 3435. Environmental Pollution: Fate and Transport. (4 Hours)**

Provides a systematic approach to analyzing the fate and transport of pollutants within natural systems. Equilibrium modeling and reactive transport modeling are used to assess the predominant processes that control the movement and persistence of pollutants in water, soil, and air. Topics include mass transfer across multiple phases; physical, chemical, and biological transformations of substances; transport processes (diffusion, dispersion, advection, interphase mass transport); eutrophication of lakes; conventional pollutants in rivers and estuaries; groundwater contamination; and atmospheric deposition.

**Prerequisite(s):** CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1214 with a minimum grade of D-

**ENVR 3540. Environmental Psychology. (4 Hours)**

Incorporates themes from cognitive psychology and environmental science to examine how people understand the environment and their place in it and how this understanding varies with culture, informal experience, and formal education. Examines relations between environmental cognition, environmental attitudes, values and norms, and sustainable behavior.

**Prerequisite(s):** ENVR 1101 with a minimum grade of D- or ENVR 1400 with a minimum grade of D- or PSYC 1101 with a minimum grade of D-

**ENVR 3600. Oceanography. (4 Hours)**

Presents an integrated overview of biological, chemical, physical, and geological processes operating in the world's oceans. Emphasizes understanding the fragility and resilience of marine systems in the face of human-driven perturbations such as habitat fragmentation, elevated sea surface temperature and acidification, non-native species, nonsustainable fishing and aquaculture, and coastal land use. Offers students an opportunity to prepare for further course work in both marine biology and in earth, oceans, and environmental change.

**ENVR 3800. Plants and Society. (4 Hours)**

Introduces the anatomy, physiology, ecology, diversity, and management of economically relevant plants. Applies plant biology to human nutrition, biofuels, wood, cloth, and medicines. Offers insight into cultural uses and values of plants across the globe. Also discusses traditional and new forms of plant management techniques, along with their advantages and disadvantages for sustainability.

**Prerequisite(s):** EEMB 1101 with a minimum grade of D- or ENVR 1101 with a minimum grade of D- or ENVR 1400 with a minimum grade of D-

**Corequisite(s):** ENVR 3801

**ENVR 3801. Lab for ENVR 3800. (1 Hour)**

Accompanies ENVR 3800. Offers students an opportunity to interact with plants on a weekly basis, while applying their observational, creative, identification, and technical skills. Introduces basic plant biology and physiology principles, along with their application for plant care. Focuses on the care techniques for common landscaping as well as household, edible, medicinal, and other economically important plants.

**Corequisite(s):** ENVR 3800

**ENVR 3850. Sustainable Agriculture. (4 Hours)**

Focuses on the natural science and management of sustainable agricultural systems. Introduces agricultural principles for soil management, pest management, and crop planning. Examines different agricultural systems including row cropping, indigenous food forests, vertical farming, and integrated crop-livestock systems. Evaluates the economic, policy, and social justice barriers to scaling sustainable agriculture. Discusses climate change resilience of sustainable agricultural systems.

**Prerequisite(s):** EEMB 1101 with a minimum grade of D- or ENVR 1101 with a minimum grade of D- or ENVR 1400 with a minimum grade of D-

**ENVR 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENVR 4000. Science Communication and Professional Development. (4 Hours)**

Covers professional skills such as writing cover letters, crafting resumés, interviewing, creating a biographical sketch, and developing overall confidence by connecting to audiences. Science communication focuses on connecting with nonscientific audiences to convey complex scientific concepts and engaging diverse stakeholders to solve pressing societal problems using scientific approaches. Covers general principles of messaging, based on an understanding of how people learn and make decisions, using techniques such as narrative storytelling, visualizations, and theatrical improvisation and other art forms. Offers students an opportunity to develop tools to highlight their strengths, market their skills, explore potential jobs and career paths, and understand how to best prepare for those positions. Designed to integrate with ENVR 4050.

**ENVR 4050. Solving Emerging Environmental Challenges through Capstone. (4 Hours)**

Gathers students from across the various environmental and sustainability sciences concentrations to solve environmental problems that are of concern to various stakeholders. Students perform service-learning with a number of not-for-profit and government agencies to identify specific environmental challenges to tackle. Students work in teams that unite social scientists, sustainability experts, conservation biologists and ecologists, and physical scientists to bring the specific expertise gained during their concentration studies together to tackle pressing environmental challenges. Offers students an opportunity to provide solutions to the problems proposed by our stakeholders, as well as to learn leadership and communication skills needed to head up a large project and to thrive in a transdisciplinary environment.

**Attribute(s):** NUpath Capstone Experience

**ENVR 4500. Applied Hydrogeology. (4 Hours)**

Covers the origin, distribution, and flow of groundwater in permeable sediments and bedrock; hydrological and geological characteristics of aquifers; regional flow systems emphasizing rock structure, stratigraphy, and other aspects of the geological environment; principles of hydrogeologic mapping and analysis; and introduces well testing and well hydraulics. Uses methods of collecting data about the physical distribution and properties of water and its interaction with geologic materials in the subsurface, including its chemical composition, and mathematical models to interpret the direction and velocity of groundwater flow. Considers remediation strategies for dealing with contaminated water in the subsurface.

**Prerequisite(s):** (ENVR 1200 with a minimum grade of D- or ENVR 1400 with a minimum grade of D-); (MATH 1241 with a minimum grade of D- or MATH 1251 with a minimum grade of D- or MATH 1341 with a minimum grade of D- )

**Corequisite(s):** ENVR 4501

**Attribute(s):** NUpath Analyzing/Using Data

**ENVR 4501. Lab for ENVR 4500. (1 Hour)**

Accompanies ENVR 4500. Covers topics from the course through various experiments.

**Corequisite(s):** ENVR 4500

**ENVR 4504. Environmental Pollution. (4 Hours)**

Describes models and methods for predicting fate and transport of organic contaminants within and between environmental media, including molecular diffusion, transport across boundaries, and box models. Uses chemical structure and thermodynamic properties to predict physical processes that control the distribution of contaminants between the atmosphere, fresh and marine surface waters, groundwater, soils, sediments, and biota. Introduces concepts linking environmental chemistry with ecotoxicology, including bioaccumulation, food web models, and risk assessment. Uses case studies and real-world scenarios to illustrate important concepts. Offers students an opportunity to develop the tools and skills necessary to determine the fate of organic chemicals released to the environment.

**Prerequisite(s):** (CHEM 1161 with a minimum grade of D or CHEM 1214 with a minimum grade of D ); (EEMB 1101 with a minimum grade of D- or ENVR 1101 with a minimum grade of D- or ENVR 1200 with a minimum grade of D- or ENVR 1400 with a minimum grade of D- )

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**ENVR 4505. Wetlands. (4 Hours)**

Presents an interdisciplinary overview of the physical, biological, and cultural aspects of wetlands. Topics covered include definitions, classification systems, origins, human use, and natural processes of wetland environments. Offers students an opportunity to learn about wetland hydrology, soils, and vegetation and their relationship to ecosystem processes, societal values, and management. Includes reading and analyzing the scientific literature and conducting in-class activities.

**Prerequisite(s):** EEMB 1101 with a minimum grade of D- or ENVR 1101 with a minimum grade of D- or ENVR 1200 with a minimum grade of D- or ENVR 1400 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**ENVR 4900. Earth and Environmental Science Capstone. (1 Hour)**

Offers students an opportunity to reflect about what they have learned in the major, in their coursework, and experiential learning. With help from faculty, students identify topics for individual research tailored to their interests and the course content. Requires writing with revision to produce a final capstone paper.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**ENVR 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**Attribute(s):** NUpath Capstone Experience

**ENVR 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** ENVR 4970 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience

**ENVR 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENVR 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**ENVR 4996. Experiential Education Directed Study. (4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major. Restricted to those students who are using the course to fulfill their experiential education requirement. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**ENVR 4997. Senior Thesis. (4 Hours)**

Offers students an opportunity to prepare an undergraduate thesis under faculty supervision.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**ENVR 5000. Community Stakeholder Engagement in Environmental Management and Research. (4 Hours)**

Introduces the history and theories of public participation in environmental policy settings to reflect on what kinds of participatory processes work best, for what purposes, and under which conditions. Environmental problems of the 21st century can be effectively addressed using processes that link sound scientific analysis with effective public deliberation. Applies principles studied to stakeholder and community engagement in science, research, or policy. Covers best practices for administering participatory processes and community engagement for community science, citizen science, or other participatory practices.

**Attribute(s):** NUpath Societies/Institutions

**ENVR 5115. Advanced Topics in Environmental Geology. (4 Hours)**

Examines selected topics in geology through an understanding of the basic processes, materials, and evolution. Topics include basin analysis, landform evolution, volcanology, or regional geology. May be repeated without limit.

**ENVR 5150. Climate and Atmospheric Change. (4 Hours)**

Offers an in-depth view of the processes that drive change in Earth's climate system. Examines the modern climate system and how and why climate changes through time. Introduces the tools used to explore past climates and changes, and explores the long-term and short-term controls on the climate system. Also introduces the application of climate models to develop future climate projections. Offers students an opportunity to obtain hands-on experience analyzing and interpreting climate data and model output.

**Prerequisite(s):** (ENVR 1200 with a minimum grade of D- or ENVR 2200 with a minimum grade of D- ) or (PHYS 1151 with a minimum grade of D- ; PHYS 1152 with a minimum grade of D- ; PHYS 1153 with a minimum grade of D- ) or graduate program admission

**ENVR 5190. Soil Science. (4 Hours)**

Provides a description and evaluation of the physical, chemical, and biological properties of soils. Includes soil formation, soil types, and processes that occur in soil including the importance of these processes for the soil productivity and management of soil. Also covers sources, reactions, transports, and fates of chemical species in soils and associated water and air environments, as well as the chemical behavior of elements and compounds and the phenomena affecting natural and anthropogenic materials in soils.

**Prerequisite(s):** ENVR 1101 with a minimum grade of D- or ENVR 1200 with a minimum grade of D- or ENVR 1400 with a minimum grade of D- or ENVR 2310 with a minimum grade of D- or graduate program admission

**ENVR 5201. Geologic Field Seminar. (4 Hours)**

Studies aspects of geology/environmental science associated with a particular field setting, in the classroom, followed by an intensive field investigation. Examples include carbonate petrology and reef ecology, then field studies in the Bahamas; glacial geology and volcanology, followed by field studies in Iceland; or stratigraphy of the U.S. Southwest, with field studies in the Grand Canyon. Focuses on using field observations and field data to interpret modern and ancient geologic processes. May be repeated without limit.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Integration Experience, NUpath Natural/Designed World

**ENVR 5202. Environmental Science Field Seminar Abroad. (4 Hours)**

Offers an intensive environmental science field study experience associated with a particular off-campus geographic setting, such as Iceland, Newfoundland, Bahamas, etc. Offers students an opportunity to learn the principles of field study, to learn to recognize and record significant data, and to reach conclusions about a range of field-based problems being studied. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience, NUpath Natural/Designed World

**ENVR 5210. Environmental Planning. (4 Hours)**

Examines aspects of surface runoff from geomorphic and hydrologic perspectives. Develops methods for description and calculation of major river and drainage basin processes and applies the results to the planning process. Examines human modification of these systems—including urbanization, dams, and channelization—and applies this information to an understanding of regulatory processes. This is a writing-intensive course.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or graduate program admission

**Attribute(s):** NUpath Writing Intensive

**ENVR 5220. Ecosystem-Based Management. (4 Hours)**

Introduces the principles and practice of ecosystem-based management. Covers how ecosystem-based management draws from social, economic, and ecological principles, as well as how these principles are fundamentally coupled. Begins by covering the evolution of resource management, from single-species to ecosystem-based approaches, including the strengths and challenges of each approach. Focuses on how ecosystem-based management has been applied to terrestrial, freshwater aquatic, and marine ecosystems, including challenges and successes of adopting this approach. Draws from a wide range of examples, including marine protected areas, terrestrial and marine spatial planning, and habitat restoration. Designed for upper-intermediate or advanced undergraduates and graduate students in environmental science and related fields.

**ENVR 5260. Geographical Information Systems. (4 Hours)**

Examines geographical information systems (GIS), a way to input, store, analyze, and display spatial data (data with a geographic location). Introduces the major components and applications of this exciting new tool. Consists of two lectures and one laboratory period a week. Laboratory exercises introduce methods of data analysis as well as practical issues of how to manipulate various GIS software packages.

**Attribute(s):** NUpath Creative Express/Innov

**ENVR 5350. Sustainable Energy and Climate Solutions. (4 Hours)**

Examines the role of sustainable energy on emissions from energy production and the resulting impacts on climate changes. Introduces current observations, predictions of future climate change, and the resulting impacts on ecological and human systems. Assesses past and current sources of U.S. energy-related and non-energy-related sources of greenhouse gases. Reviews sustainable energy alternatives and emission reduction strategies with a focus on comparing moderate and deep decarbonization strategies and the overall goal of reaching zero net emissions.

**ENVR 5410. Human Behavior and Sustainability. (3 Hours)**

Offers a graduate-level introduction to the interdisciplinary field of human behavior and sustainability sciences. Explores an emerging literature embracing the complexity of social-ecological systems to better engage with the processes that reinforce unsustainable pathways and those that might be leveraged toward more sustainable futures. Focuses on understanding how observations about the psychology of individuals and collectives, and their relationship to institutions, have been theorized in relation to the environment and the approaches and methodologies used to test and describe such relationships.

**ENVR 5450. Applied Social-Ecological Systems Modeling. (4 Hours)**

Covers the key frameworks, theories, and approaches for conducting social-ecological systems (SES) research. Involves topic and paper discussions focused on developing detailed knowledge and agility at describing the theoretical and applied foundations of interdisciplinary SES research. Includes semester-long projects to develop hands-on skills for conducting robust, methodologically sound studies of social-ecological systems. Particularly emphasizes participatory modeling as a tool for both scientific inquiry and stakeholder engagement. Students complete a participatory modeling project, including all steps of the scientific process, and have an opportunity to gain experience with research design, data collection, analysis, interpretation, and communication.

**ENVR 5500. Advanced Biostatistics. (4 Hours)**

Presents an overview of advanced statistical concepts and approaches for studying biological systems by explaining the mathematical underpinnings of statistical methods and demonstrating how to implement them in the R programming language. Topics include general(ized) linear models, likelihood, model selection, mixed-effects models, multivariate statistics, and machine learning.

**Prerequisite(s):** ENVR 2500 with a minimum grade of C- or graduate program admission

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**ENVR 5563. Advanced Spatial Analysis. (4 Hours)**

Offers an in-depth evaluation of theoretical, mathematical, and computational foundations of geographic information systems (GIS). Examines advanced concepts and techniques in GIS analysis and spatial statistics methods. Topics include spatial information theory, database theory, mathematical models of spatial objects, and GIS-based representation.

**Prerequisite(s):** ENVR 3300 with a minimum grade of D- or ENVR 5260 with a minimum grade of C- or ENVR 5260 with a minimum grade of C-

**ENVR 5600. Coastal Processes, Adaptation, and Resilience. (4 Hours)**

Introduces the forcing and response of the built and natural coastal environment, including hurricanes and extratropical storms, wind waves, astronomical tides, storm surges, currents, sediment transport, and morphological changes. Seeks to provide an overview of the physical processes and interaction with human activity at the water and land interface, including anthropogenic, natural, and nature-based features for coastal defense. Uses examples and case studies of climate adaptation plans to illustrate alternatives to increase coastal resiliency. Emphasizes the challenges to developing resilience solutions in urban coastal areas, where population growth coupled with sea-level rise and climate extremes exacerbate exposure of people and infrastructure to flood hazards.

**ENVR 5610. Technology and the Blue Economy. (4 Hours)**

Focuses on emerging technology and the global blue economy that generates trillions of U.S. dollars in economic activity. Introduces key sectors including global shipping, operations of port and harbors, fishing and aquaculture, tourism, ocean monitoring and exploration, finance models, energy, and minerals extraction. Examines challenges to a sustainable and equitable blue economy including global biodiversity loss, marine pollution, decarbonization, access to capital, and national security. Includes virtual field trips to companies and institutions involved in technology and the blue economy.

**ENVR 5670. Global Biogeochemistry. (4 Hours)**

Examines the biological, chemical, and physical interactions that shape our global environment. These interactions combine in the global biogeochemical cycles. Industrial emission of gases, use of fertilizers and plastics, and the expansion of cities are altering the biogeochemical cycling of the elements carbon, nitrogen, and phosphorus at rates unprecedented in the geological record. Uses lectures and the latest update to Chapter 6, "Carbon and Other Biogeochemical Cycles," of the International Panel on Climate Change report to explore the main interactions between human activity, biogeochemical change, and climate. Discusses primary literature to delve deeper into these interactions.

**Attribute(s):** NUpath Natural/Designed World

**ENVR 5700. Streams and Watershed Ecology. (4 Hours)**

Studies the physical, chemical, and biological processes in streams and surrounding watersheds. Explores the hydrology, structure, function, and biota of running waters and the landscape that supports them. Examines current and relevant issues in stream science and policy, including natural and anthropogenic disturbance, climate change, and management and restoration techniques in stream systems. Provides broad foundational knowledge on stream science, which offers students an opportunity to learn experimental techniques and employ them in the field. The first half of the course consists of lecture and discussion, while the second half is taught principally in the field.

**Prerequisite(s):** EEMB 2302 with a minimum grade of C- or ENVR 1400 with a minimum grade of C-

**ENVR 5750. Urban Ecology. (4 Hours)**

Investigates the myriad ways that natural systems intersect with human-dominated landscapes, including urban hydrology, nutrient cycling, and the distribution of organisms in cities. Urbanization is rapidly expanding with over half of humans currently inhabiting urban landscapes. The conversion of natural areas to human-dominated landscapes is resulting in the loss of biodiversity, habitat connectivity, and ecosystem services. It is also changing how we perceive and value natural systems. Evaluates the ecology *in* cities but also ecology *of* cities, including how cities integrate into larger landscapes; ecosystem service provisioning; and the biological, cultural, and psychological value of urban nature for people. Culminates by looking to the future of how urban spaces adapt to climate change, increasing populations, and other emerging issues.

**Prerequisite(s):** EEMB 2302 with a minimum grade of C- or ENVR 1101 with a minimum grade of C- or ENVR 1400 with a minimum grade of C- or graduate program admission

**ENVR 5800. Climate Adaptation and Nature-Based Solutions. (4 Hours)**

Examines ways of measuring ecological resilience, adaptation capacity, adaptation and mitigation strategies, and developing transformation pathways to new stable states. The effects of climate change are having wide-ranging impacts on people and nature. Climate mitigation and adaptation can slow or stop climate impacts and decrease their severity. Natural mitigation and adaptation strategies (nature-based solutions) offer sustainable approaches to respond to these challenges. Evaluates climate change impacts on natural systems and explores strategies that reduce and adapt to these changes, including impact assessment; evaluation of ecological health for ecosystems, habitats, communities, and populations; and response prioritization. Offers students an opportunity to build skills in informing and evaluating the potential for these strategies at local, regional, and global scales and opportunities to deploy these strategies.

**Prerequisite(s):** (ENVR 1101 with a minimum grade of C- or EEMB 2302 with a minimum grade of C-) or graduate program admission

**ENVR 5984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**ENVR 6000. Professional Development for Co-op. (1 Hour)**

Introduces the cooperative education program. Offers students an opportunity to develop job-search and career-management skills; to assess their workplace skills, interests, and values and to discuss how they impact personal career choices; to prepare a professional résumé; and to learn proper interviewing techniques. Explores career paths, choices, professional behaviors, work culture, and career decision making.

**ENVR 6102. Environmental Science and Policy Seminar 2. (4 Hours)**

Critically explores fundamental and modern theory, methodologies, and practices for conserving and managing coupled social-ecological systems (SES). Focuses on science and policy of environment management through the lens of coupled SES. Historically, the majority of studies focused on human-environment interactions have typically involved measuring and describing the negative impacts of human populations and development on natural ecosystems. More recently, however, environmental science and practice have experienced a paradigm shift to where now humans and the natural environment are recognized as tightly coupled systems. From an SES perspective, humans continue to shape the structure and function of ecosystems through both stressors and stewardship. However, a key advancement is the recognition that people and their behavior are directly influenced by structure, function, and services of ecosystems.

**ENVR 6150. Food Security and Sustainability. (4 Hours)**

Explores the science of sustainable food production around the world and examines the issues related to nutrition and hunger, food safety, and food production. Discusses issues such as population growth, climate change, and sustainability, which are presented as thematic topics. Also discusses issues such as soil health, genetically modified (and engineered) foods, water use, governmental food guidelines, and human health. Pulls focus on the thematic topics from scientific literature but also includes additional sources of information, such as gray literature, media coverage, documentaries, and popular nonfiction. Explores local examples of sustainable agriculture, including incentives in food security and sustainability in New England.

**ENVR 6200. Water Resources. (4 Hours)**

Focuses on the hydrologic cycle, including global and regional patterns of water movement; characteristics of surface and groundwater systems, including the linkage between streams, rivers, lakes, wetlands, groundwater, and the sea; water management issues and regulations that have been enacted to control the use of water as a resource; water quality measures for surface water and groundwater; and examples of water use conflicts and emerging water issues. Case studies of specific water challenges include examples from the United States, Asia, Africa, the Middle East, and Europe.

**ENVR 6500. Biostatistics. (4 Hours)**

Offers an in-depth overview of statistical methods used to analyze data, with a focus on the biological sciences as well as nonbiological applications. Covers probability theory, Bayes' theorem, hypothesis testing, derivations of statistical distributions, models used for inference with categorical and/or continuous data, linear models, model selection, information theory, and nonparametric methods in statistics. Offers students an opportunity to learn how to apply models to data in supervised lab sessions in the R programming environment.

**Corequisite(s):** ENVR 6501

**ENVR 6501. Lab for ENVR 6500. (1 Hour)**

Accompanies ENVR 6500. Introduces the core principles for programming in R, key functions, and application to real datasets.

**Corequisite(s):** ENVR 6500

**ENVR 6954. Co-op Work Experience - Half Time. (0 Hours)**

Provides eligible students with an opportunity for part-time work experience.

**Prerequisite(s):** MATH 6000 with a minimum grade of S

**ENVR 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENVR 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**ENVR 8410. Special Topics in Human Behavior and Sustainability. (3 Hours)**

Offers in-depth analysis of critical topics in human behavior and sustainability sciences. Specific topics vary by semester. May be repeated up to five times for a maximum of 18 semester hours.

## Ecology, Evolution, and Marine Biology (EEMB)

**EEMB 1101. Foundations in Ecology and Evolutionary Biology. (4 Hours)**

Introduces students to the foundational principles of ecology and evolutionary biology. Merges traditional lectures on foundational topics in ecology and evolutionary biology (adaptation, mechanisms of evolution, community and ecosystems ecology) with explorations of local field sites and an introduction to field ecology. Students spend several weeks of the semester designing and implementing independent field research projects, through which they are exposed to the foundation of scientific inquiry, including hypothesis testing, collecting, managing, and analyzing data, and presenting their findings.

**Corequisite(s):** EEMB 1102

**Attribute(s):** NUpath Natural/Designed World

**EEMB 1102. Lab for EEMB 1101. (1 Hour)**

Accompanies EEMB 1101. Covers topics from the course through various experiments.

**Corequisite(s):** EEMB 1101

**EEMB 1105. Foundations in Ecological and Evolutionary Genomics. (4 Hours)**

Introduces students to the foundational principles of molecular ecology with an emphasis on applications of high-throughput sequencing techniques to answer questions in ecology and evolutionary biology. Covers foundational topics in ecological and evolutionary genomics (central dogma, structure of nucleic acids, genetic variation, tools in molecular ecology, understanding genomes, and genomics). Practical skills development includes clean technique and proper bench skills; basic command line programming; understanding, quantifying, and analyzing sequence variation; and visualizing genomic data for formal scientific presentations.

**Corequisite(s):** EEMB 1106

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**EEMB 1106. Lab for EEMB 1105. (1 Hour)**

Accompanies EEMB 1105. Covers topics from the course through various experiments. Focuses on providing firsthand experience using tools from molecular ecology to test ecological and/or evolutionary hypotheses.

**Corequisite(s):** EEMB 1105

**EEMB 1145. Beginning Scuba. (1 Hour)**

Focuses on basic skin diving and scuba diving skills, with emphasis on safety. Requires lab fee. Requires ability to pass a swim test and basic comfort in the water.

**EEMB 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EEMB 2302. Ecology. (4 Hours)**

Offers students an opportunity to learn about the environmental and biological processes that control the distribution and abundance of species and controlling factors that operate on individuals, populations, and communities. The lecture and laboratory introduce a set of generalizable concepts that are of fundamental importance to plant and animal life on the land and in the sea and provide hands-on experiential learning that reinforce concepts covered in lecture. Offers students an opportunity to become proficient in the following: (a) understanding research results the primary literature; (b) conducting a research experiment; (c) interpreting the results of in-class research; (d) communicating results as manuscript.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C

**Corequisite(s):** EEMB 2303

**Attribute(s):** NUpath Formal/Quant Reasoning, NUpath Writing Intensive

**EEMB 2303. Lab for EEMB 2302. (1 Hour)**

Accompanies EEMB 2302. Covers topics from the course through various experiments.

**Corequisite(s):** EEMB 2302

**EEMB 2400. Introduction to Evolution. (4 Hours)**

Introduces evolutionary thinking, including contemporary examples of evolution. To understand the evolution of Charles Darwin's "endless forms most beautiful," the course adopts an integrative approach that includes information from ecology, genetics, molecular biology, biogeography, and paleobiology. Considers mechanisms of evolutionary change—how does it happen? Examines adaptation, the process by which attributes of an organism change to enhance fitness and the evolutionary history of life on our planet—what was the first living thing, how does speciation occur, what have we learned about evolution of life in the distant past, and how did humans evolve. Includes student presentations and analysis of scientific literature.

**Prerequisite(s):** BIOL 1107 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- or EEMB 1101 with a minimum grade of D- or ENVR 1400 with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World

**EEMB 2610. Plant Biology. (4 Hours)**

Examines the biology and diversity of plants and plantlike organisms. Covers introduction to plant biology, anatomy and structure, physiology and development, evolution and classification, and ecology of plants. Emphasizes how global climate change affects the biology and ecology of plants in different ecosystems and biomes.

**Prerequisite(s):** BIOL 1107 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- or EEMB 1101 with a minimum grade of D- or EEMB 1105 with a minimum grade of D- or ENVR 1400 with a minimum grade of D-

**EEMB 2700. Marine Biology. (4 Hours)**

Examines biological aspects of natural ocean ecosystems and the physical processes that regulate them. Covers distributions, abundances, and interactions of marine organisms; interactions between organisms and the transformation and flux of energy and matter in marine ecosystems; and aspects of physiology related to marine species distributions, abundances, and roles. Students generate, evaluate, discuss, and present data from primary research and apply their knowledge of the scientific method and biological concepts through the creation of a written grant proposal.

**Prerequisite(s):** (BIOL 1107 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- or BIOL 1115 with a minimum grade of D- or EEMB 1101 with a minimum grade of D- ); (ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C )

**Corequisite(s):** EEMB 2701

**Attribute(s):** NUpath Natural/Designed World, NUpath Writing Intensive

**EEMB 2701. Lab for EEMB 2700. (1 Hour)**

Accompanies EEMB 2700. Covers topics from the lecture course through discussions and experiments.

**Corequisite(s):** EEMB 2700

**EEMB 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EEMB 3250. Freshwater Ecology. (4 Hours)**

Examines the abiotic characteristics of freshwater ecosystems, such as their formation, distribution, and physical/chemical characteristics. Freshwater habitats have long been used as model systems because of their convenient attributes (for example, lakes are largely contained ecosystems with clearly defined edges, and most organisms stay within these aquatic boundaries). Studies how these first principles influence biotic community assembly, drawing on foundational studies that have used freshwater habitats to illustrate dynamics such as seasonal succession, nutrient limitation, trophic cascades, and transitions between alternative states. Examines the linkages between freshwater ecosystems and other ecosystems and the relationship between freshwater systems and the human societies that rely on their ecosystem services.

**Prerequisite(s):** EEMB 2302 with a minimum grade of D-

**EEMB 3455. Ecosystems Ecology. (4 Hours)**

Focuses on the foundational principles of ecosystems ecology. Examines the flow of energy and materials through both the biosphere (plants, animals, and microbes) and the geosphere (soils, atmospheres, and oceans) and the role that humans are playing in altering these key fluxes. Studies elemental cycles that are critically important for human and environmental sustainability—including carbon, nitrogen, and phosphorus—and examines similarities and differences in these cycles and flows while drawing on examples from both terrestrial and marine systems. Seeks to understand how changes in ecosystem structure ultimately affect ecosystem function and how this translates into the important services ecosystems provide.

**Prerequisite(s):** BIOL 1107 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1214 with a minimum grade of D- or EEMB 2302 with a minimum grade of D- or ENVR 1200 with a minimum grade of D- or ENVR 2200 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**EEMB 3460. Conservation Biology. (4 Hours)**

Explores conservation biology, an interdisciplinary science that focuses on conservation of biological diversity at multiple levels. Emphasizes the causes and consequences of biodiversity loss and demonstrates how ecological and evolutionary principles are applied to conservation problems. Covers sustainability; climate change; introduced species; conservation of threatened and endangered species; and pollution, disease, and habitat restoration using examples from marine, aquatic, and terrestrial systems. Offers students an opportunity to read, discuss, evaluate, and present data from primary research through written assignments and oral debates and to apply this knowledge to conservation issues. Emphasizes critical thinking, problem solving, and recognizing multiple perspectives.

**Prerequisite(s):** BIOL 1107 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- or BIOL 1115 with a minimum grade of D- or EEMB 1101 with a minimum grade of D- or ENVR 1101 with a minimum grade of D- or ENVR 1400 with a minimum grade of D-

**Attribute(s):** NUpath Writing Intensive

**EEMB 3465. Ecological and Conservation Genomics. (4 Hours)**

Offers an overview of ecological and conservation genetics, an interdisciplinary science that focuses on understanding the processes that determine genetic diversity at the individual to population level. Focuses on fundamental concepts in evolutionary ecology and population and quantitative genetics, then applies those concepts to solving real-world problems in conservation science. Covers harvested populations, inbreeding, climate change, introduced species, conservation of threatened and endangered species, adaptation, and habitat restoration. Exposes students to multiple sides of these issues and the science that underpins them. Offers students an opportunity to develop the R programming skills required to analyze the complex data sets that often emerge when addressing cutting-edge questions in genetics. Includes writing and coding exercises and mathematical derivations. Emphasizes critical thinking and problem solving.

**Prerequisite(s):** BIOL 2301 with a minimum grade of C- or CS 2500 with a minimum grade of C- or ECON 2350 with a minimum grade of C- or EEMB 2400 with a minimum grade of C- or ENVR 2500 with a minimum grade of C- or MATH 3081 with a minimum grade of C-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**EEMB 3466. Disease Ecology. (4 Hours)**

Covers the fundamentals of disease ecology and evolution. Focuses on how disease can impact the physiology of organisms and how this can, in turn, alter communities and ecosystems. Topics include mathematical theory on host-pathogen interactions; empirical studies of human, wildlife, insect, and plant host populations; emerging infectious diseases; effects on host behavior; host-parasite coevolution; multihost and multipathogen systems; and anthropogenic effects on disease. Includes writing exercises, with a special emphasis on critical thinking and problem solving.

**Prerequisite(s):** BIOL 1107 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- or EEMB 1101 with a minimum grade of D- or ENVR 1101 with a minimum grade of D- or ENVR 1400 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**EEMB 3475. Wildlife Ecology. (4 Hours)**

Focuses on wildlife ecology and management, with an emphasis on terrestrial species. Introduces habitat use, behavior, wildlife conservation, parasites and pathogens, wildlife sampling, wildlife management, food and nutrition, population viability, and conservation genetics. Offers students an opportunity to engage in analyzing primary literature, collection, interpretation, and wildlife data and using basic mathematical models.

**Prerequisite(s):** EEMB 2302 with a minimum grade of C

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**EEMB 3600. Animal Behavior. (4 Hours)**

Covers the fundamental principles of animal behavior by focusing on the physiological, ecological, and genetic factors that promote the evolution of diverse behavioral responses in the animal kingdom. Offers students an opportunity to become critical thinkers and readers through discussion of the how and why animals evolve behaviors that appear to increase and/or decrease their fitness.

**Prerequisite(s):** BIOL 1113 with a minimum grade of D or BIOL 2299 with a minimum grade of D or EEMB 1105 with a minimum grade of D

**EEMB 3700. Desert Ecology. (4 Hours)**

Offers students an opportunity to obtain a basic understanding of fundamental ecological processes taking place in desert environments. Familiarizes students with how environmental and biological processes interact and influence the distribution and abundance of species in these arid biomes while recognizing the impact that human societies have on desert life and identifying sustainable solutions to ameliorate our ecological footprint. Introduces students to foundational concepts of fundamental importance to desert plant and animal life. Uses an ecological perspective to surround students with a rich social/cultural milieu including interactions with Israeli, Palestinian, and Bedouin communities.

**Prerequisite(s):** EEMB 2302 with a minimum grade of D- ; EEMB 2303 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity

**EEMB 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EEMB 4000. Applied Conservation Biology. (4 Hours)**

Studies landscape-scale conservation in Transylvania and the Carpathian Mountains of Romania. Working intensively with Foundation Conservation Carpathia, explores efforts to build Europe's largest national park. Offers students an opportunity to learn from local conservation leaders, collect data, and develop plans to help launch the "Yellowstone of Europe." Focuses on large carnivore conservation (brown bears, lynx, and wolves); sustainable agriculture; resource management in a country formerly under communist rule; and balancing urban and rural conservation needs. Explores Romania's rich cultural heritage in Sighisoara, a UNESCO World Heritage Site, and Vacaresti Nature Park, a constructed urban wetland in the heart of Bucharest. Requires prior completion of one laboratory science course or permission of instructor.

**Attribute(s):** NUpath Integration Experience, NUpath Natural/Designed World

**EEMB 4001. Landscape and Restoration Ecology. (4 Hours)**

Topics include ecosystem processes, spatial patterns, disturbance, species distributions, invasive species, and habitat loss. Offers students an opportunity to participate in activities in which they look at and interpret spatial data. Course format includes group work, analyzing the scientific literature, and in-class activities.

**Prerequisite(s):** BIOL 1107 with a minimum grade of C or BIOL 1111 with a minimum grade of C or EEMB 1101 with a minimum grade of C or ENVR 1101 with a minimum grade of C or ENVR 1400 with a minimum grade of C

**Attribute(s):** NUpath Natural/Designed World

**EEMB 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EEMB 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**EEMB 5130. Population Dynamics. (4 Hours)**

Offers a comprehensive overview of the mathematical and computational concepts needed to construct dynamical models. Lectures describe how to mathematically derive and model the effects of species interactions, space, disease, and environmental variability in order to understand the dynamics of populations in a changing world. Emphasizes the mathematical tools required to analyze the dynamical behavior of models (e.g., stability, invasion, graphical, and numerical analyses) and validate their predictions using empirical data (e.g., via maximum likelihood and optimization methods). Tutorials demonstrate how to implement, analyze, and test models using the free R programming language.

**Prerequisite(s):** ((MATH 1241 (may be taken concurrently) with a minimum grade of D- or MATH 1251 (may be taken concurrently) with a minimum grade of D- or MATH 1341 (may be taken concurrently) with a minimum grade of D-); (ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C )) or graduate program admission

**Attribute(s):** NUpath Writing Intensive

**EEMB 5303. Marine Biology Careers Seminar. (1 Hour)**

Covers the information and tools needed to begin pursuing career opportunities in marine biology. Encourages students to explore a variety of career paths, construct résumés, contact potential employers for their internship and permanent positions. Presents invited speakers from state and federal agencies, and from private consulting firms, to talk about their work and career track.

**EEMB 5305. Professional Development for Ocean Sciences. (2 Hours)**

Designed to assist Three Seas students in securing a graduate research internship. Seeks to provide students with the information needed to pursue diverse career opportunities in marine biology. Provides hands-on experience with an array of science communication tools, including resumés/CVs, cover letters, and social media. Speakers from academia, informal science education organizations, and the media present talks on their work and career tracks.

**EEMB 5504. Biology of Corals. (2 Hours)**

Covers a variety of topics including basic coral biology, the coral/algae symbioses, the mechanisms of coral bleaching, coral microbiology and disease, coral calcification and ocean acidification, and coral speciation and hybridization. Supplements lectures with readings from the primary literature. Focuses on active areas of research and hands-on learning through lab and field activities.

**Prerequisite(s):** BIOL 2311 with a minimum grade of D- or EEMB 2302 with a minimum grade of D- or graduate program admission

**Corequisite(s):** EEMB 5505

**Attribute(s):** NUpath Analyzing/Using Data

**EEMB 5505. Lab for EEMB 5504. (1 Hour)**

Accompanies EEMB 5504. Focuses on relevant research questions while providing practical training techniques in coral biology. Hands-on learning includes visual surveys of reef transects, quadrat sampling, coral identification, enumeration of zooxanthellae with a hemocytometer, PAM fluorometry, ImageJ analysis, coral homogenization, and Vibrio plating.

**Corequisite(s):** EEMB 5504

**EEMB 5506. Biology and Ecology of Fishes. (2 Hours)**

Covers fundamental concepts in reef fish biology, ecology, and conservation. Additional lecture coursework includes analysis of both group and individual research projects conducted in lab. Presents recent or ongoing research projects by the instructor and guest lecturers. Discussions are based on papers from the scientific literature and relate topics about processes and patterns of fish recruitment, reproduction, dispersal, evolution, conservation, and management.

**Prerequisite(s):** BIOL 2311 with a minimum grade of D- or EEMB 2302 with a minimum grade of D- or graduate program admission

**Corequisite(s):** EEMB 5507

**EEMB 5507. Lab for EEMB 5506. (1 Hour)**

Accompanies EEMB 5506. Studies methods to conduct research on reef fishes through class exercises and individual research projects. Hands-on learning includes common fish transect methodology, reef fish identification, cast net and handline (on scuba) fishing techniques, and specimen dissection. Emphasizes analyzing and presenting the data and writing clearly and effectively about scientific research through the lab reports.

**Corequisite(s):** EEMB 5506

**EEMB 5508. Marine Birds and Mammals. (3 Hours)**

Studies principles of classification, anatomy, physiology, behavior, and evolution of seabirds and marine mammals. Also addresses conservation and protection of animals and essential habitat. Includes field trips to observe local species.

**Prerequisite(s):** (BIOL 2311 with a minimum grade of D- or EEMB 2302 with a minimum grade of D- ) or graduate program admission

**EEMB 5510. New England Marine Biomes. (4 Hours)**

Investigates the major biomes in the northwest Atlantic, including their habitats—rocky intertidal, tidal estuaries, seagrass beds, kelp forest/rocky reef complex, soft sediments, salt marshes, and continental shelf. Studies the major chemical, physical, geological, and biological forces that shape each habitat. Investigates the ecological framework of each habitat, both in the field and in hands-on exercises. Examines the adaptations of plants, algae, and animals to their respective ecosystem. Offers students an opportunity to develop an appreciation for human-induced changes in each habitat and biome and the conservation and restoration efforts currently being used.

**Prerequisite(s):** (EEMB 2302 with a minimum grade of D- or EEMB 2700 with a minimum grade of D- or EEMB 3460 with a minimum grade of D- or EEMB 3475 with a minimum grade of D- or EEMB 4001 with a minimum grade of D- ) or graduate program admission

**EEMB 5518. Ocean and Coastal Processes. (2 Hours)**

Examines the coupling between physical and biological processes on coral reefs and adjacent habitats. Focuses on biophysical, oceanographic, and benthic-pelagic processes acting in coral reef and associated nearshore ecosystems. Specific topics include oceanographic forcing mechanisms, organismal biomechanics, hydrodynamics, and nutrient dynamics.

**Prerequisite(s):** BIOL 2311 with a minimum grade of D- or EEMB 2302 with a minimum grade of D- or graduate program admission

**Corequisite(s):** EEMB 5519

**EEMB 5519. Lab for EEMB 5518. (1 Hour)**

Accompanies EEMB 5518. Studies techniques such as estimation of turbulent diffusion coefficients, mean speed, and logarithmic layer parameters using analysis of video imagery (NIH ImageJ); deploying and recovering zooplankton traps and nets and estimating mortality using vital dyes; use of GoPro for behavioral analyses (sediment shedding in corals); estimating flux rates from active suspension feeders like sponges using dye release; and use of the YSI Exo Sonde to measure different water quality parameters.

**Corequisite(s):** EEMB 5518

**EEMB 5520. Tropical Marine Ecology. (2 Hours)**

Highlights and explores the ecological characteristics and current threats facing four tropical ecosystems—coral reefs, seagrass beds, mangrove forests, and tropical lowland rain forests. Explores the connectivity between these ecosystems and the services each provides. Examines how these ecosystems have changed under past threats and are projected to change in future conditions. Includes formal lectures, informal lectures provided in the field, field demonstrations, and interpretive hikes.

**Prerequisite(s):** BIOL 2311 with a minimum grade of D- or EEMB 2302 with a minimum grade of D- or graduate program admission

**EEMB 5522. Experimental Design Marine Ecology. (4 Hours)**

Includes introduction to and application of observational methods in three local marine habitats, experimental design, statistical analysis, R statistical computing and graphics software, and principles of marine ecology. Combines lecture, hand-on research experience, and computer laboratory and includes reading and analyzing the scientific literature and developing research projects. At the end of the semester, students are expected to demonstrate an integrative mastery of course topics by writing a scientific manuscript about a class experiment. Seeks to prepare students for practicing ecology in new environments and to provide students with the foundational knowledge necessary for pursuing more complex concepts in experimental design, statistical analysis, and marine ecology.

**Prerequisite(s):** BIOL 2311 with a minimum grade of D- or EEMB 2302 with a minimum grade of D- or graduate program admission

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Writing Intensive

**EEMB 5533. Marine Invertebrate Zoology and Botany. (2 Hours)**

Explores major groups of marine macroalgae and marine invertebrates, their ecological roles, and interrelationships. Identifies defining features of these groups and the evolutionary and ecological drivers leading to adaptations. Emphasizes important groups in the Pacific Northwest habitats, including kelp forest and rocky intertidal habitats. Hands-on learning with corequisite lab includes field identification; visits to intertidal and subtidal marine environments; and specimen observation, dissection, preparation, and cataloging.

**Corequisite(s):** EEMB 5535

**EEMB 5535. Lab for EEMB 5533. (1 Hour)**

Accompanies EEMB 5533. Covers topics from the course through various experiments.

**Corequisite(s):** EEMB 5533

**EEMB 5538. Conservation and Restoration of Marine Systems. (3 Hours)**

Designed to foster an understanding of conservation and restoration strategies in the nearshore marine system using a real-world case study approach. Students collect and analyze historical and newly collected data and use this to inform a conservation and restoration plan within the context of local, state, and federal laws. Uses real-world examples (such as aquaculture, seagrass restoration, and shoreline hardening) to build ecological goals. Seeks to build understanding and appreciation of the input of all stakeholders, including that of marginalized groups. Offers students an opportunity to produce a high-level and annotated deliverable that could serve as a template for real-world use.

**EEMB 5540. Changing Global Oceans. (2 Hours)**

Investigates the major drivers to short-, medium-, and long-term changes in the world's oceans. Compares the role of natural and human-induced changes in ocean systems. Key areas focus on the role of nonhuman animals in modifying and mitigating oceanic and atmospheric change. Explores the linkages among oceans and atmosphere through examples in the Pacific Northwest and worldwide.

**Corequisite(s):** EEMB 5541

**EEMB 5541. Lab for EEMB 5540. (1 Hour)**

Accompanies EEMB 5540. Students participate in daily, topical, paper discussions, carry out laboratory exercises, or explore and collect data in field exercises. Offers students an opportunity to acquire skills such as using oceanographic equipment, modeling simulations, data collection, and data analysis.

**Corequisite(s):** EEMB 5540

**EEMB 5542. Marine Spatial Planning. (4 Hours)**

Investigates issues of marine and coastal spatial planning (MCSP) that include offshore wind power siting, fisheries and aquaculture management, natural resource extraction, marine mammal conservation, and/or living shoreline protection and mitigation. Covers the spatial planning process from question to deliverable strategy, including assessment of stakeholder needs and potential ecosystem impacts. Offers students an opportunity to acquire and assess data, apply appropriate statistical tools, and develop spatial maps using geographic information systems (GIS) and other software. Also covers how to synthesize the planning process and develop and evaluate recommendations.

**Prerequisite(s):** EEMB 2302 with a minimum grade of D- or EEMB 2700 with a minimum grade of D- or EEMB 3460 with a minimum grade of D- or EEMB 4001 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience

**EEMB 5546. Sustainability of the Land-Sea Interface. (3 Hours)**

Explores the current issues facing management and conservation of the land-sea interface, also known as the coastal transition zone (CTZ). Evaluates the mitigation, conservation, and restoration tools that are applied to human use of the land-sea interface. Observes these tools during site visits and discusses strategies with experts in sustainability of these habitats. Synthesizes the scientific literature on CTZ tools in the northwest Atlantic and other regions with pressing sustainable land-sea use issues. Offers students an opportunity to develop skills in prioritizing and advocating for particular conservation strategies and to practice science communication skills to effectively reach a broad audience.

**Prerequisite(s):** (EEMB 2302 with a minimum grade of D- or EEMB 2700 with a minimum grade of D- or EEMB 3460 with a minimum grade of D- or EEMB 4001 with a minimum grade of D- ) or graduate program admission

**Attribute(s):** NUpath Writing Intensive

**EEMB 5589. Diving Research Methods. (2 Hours)**

Presents experimental design, sampling methodology, statistical analysis, techniques, and the use of underwater equipment to conduct subtidal research.

**EEMB 6465. Ecological and Conservation Genomics. (4 Hours)**

Provides an overview of ecological and evolutionary genomics. Covers foundational mathematical concepts in population in quantitative genetics, from individual loci up to whole genomes. Concepts covered include Hardy-Weinberg equilibrium, F statistics, signatures of natural selection in genomes and methods for detecting them, analysis of quantitative genetic evolution, hybridization, and gene expression. Also covers modern statistical methods used to analyze genomic data using the free and open source R programming environment. Builds knowledge through reading of the primary literature and advanced problem sets. The final project requires students to complete a novel data analysis of an open source genomics data set and write a research paper.

**EEMB 6475. Advanced Wildlife Ecology. (4 Hours)**

Focuses on wildlife ecology and management, with an emphasis on terrestrial species. Covers habitat use, behavior, wildlife conservation, parasites and pathogens, wildlife sampling, wildlife management, food and nutrition, population viability, and conservation genetics. Engages students in analyzing primary literature and wildlife data, collection, interpretation, and using basic mathematical models.

**EEMB 7101. Seminar in Marine Sciences. (2 Hours)**

Offers students an opportunity to lead critical discussions of recent and classic papers from primary and secondary literature in marine sciences. Discusses the important scientific paradigms and addresses strengths and weaknesses of these papers from the perspective of scientific communication, including design and presentation of data in figures and tables; the role of synthesis in justifying new concepts; and how terminology and jargon evolve in scientific subdisciplines. Students write occasional reviews of these papers as if they had just been submitted to a journal for consideration.

**EEMB 7102. Seminar in Ecology and Evolutionary Biology. (2 Hours)**

Offers an overview of major concepts in the fields of ecology and evolution and how these concepts can be synthesized under a common framework. The first half of the course is organized according to major areas of evolutionary biology, from quantitative genetics to population genetics and phylogenetics and their synthesis. Quantitative genetics, population genetics, and phylogenetics have been historically separate fields and have only recently been synthesized through genomics. Note that quantitative genetics is a field that studies the evolution of phenotypes and requires no genetic information. The second half of the course introduces major concepts in ecology and is designed to introduce students to the major historical underpinnings of community ecology so as to understand the utility (or lack thereof) of these concepts for modern ecology.

**EEMB 7103. Seminar in Sustainability Sciences. (2 Hours)**

Explores key papers that have shaped modern theory, methodologies, and practices of sustainability science. Sustainability science hinges on integrating social and ecological sciences to assess the sustainability of human-environment interactions. From the social science dimension, many past studies focused on understanding how values, beliefs, and social norms shape human behavior. From an ecological perspective, much work focused on the influence of various institutional arrangements on resource and environmental sustainability. Importantly, a coupled natural-human or social-ecological systems (SES) perspective focuses on the inherently dynamic nature of these systems and interactions.

**EEMB 7104. Seminar in Geosciences. (2 Hours)**

Exposes graduate students pursuing a PhD in marine and environmental sciences to classical and recent high-impact papers in the fields of recent and deep earth history, landform evolution, microbes and their role in global biogeochemical cycling, nutrient stoichiometry, the global carbon cycle, geochemical proxies, evolution of ocean chemistry, oceanic acidification, the role of organisms in sediment and rock production, and geochemical paleoproxies. Examines applications of the above disciplines to mitigating the impacts of anthropogenic impacts on the Earth system. This is a guided readings course.

**EEMB 7674. Marine Biology Research Project. (1 Hour)**

Offers an opportunity to design and implement a scientifically rigorous independent research project that builds upon current knowledge from the primary literature, under the supervision of a faculty advisor from the program. Students conduct research at any of the program's locations and are then required to analyze data using rigorous statistical methods, write a journal-style research paper, and present their results in a research seminar. May be repeated once.

**EEMB 8101. Readings in Marine Sciences. (2 Hours)**

Designed to prepare PhD students with a concentration in marine sciences for a career in their field by offering an opportunity to learn fundamental aspects of the discipline through readings. Each student works with their Northeastern committee members at their first committee meeting to identify one reading topic per committee member. Committee members provide guidance for the student's readings around their topic. Students meet with each committee member throughout the semester to discuss the readings, ask questions, and clarify any aspects of their topics.

**EEMB 8102. Readings in Ecology and Evolutionary Biology. (2 Hours)**

Designed to prepare PhD students with a concentration in ecology and evolutionary biology for a career in their field by offering an opportunity to learn fundamental aspects of the discipline through readings. Each student works with their Northeastern committee members at their first committee meeting to identify one reading topic per committee member. Committee members provide guidance for the student's readings around their topic. Students meet with each committee member throughout the semester to discuss the readings, ask questions, and clarify any aspects of their topics.

**EEMB 8103. Readings in Sustainability Sciences. (2 Hours)**

Designed to prepare PhD students with a concentration in sustainability for a career in their field by offering an opportunity to learn fundamental aspects of the discipline through readings. Each student works with their Northeastern committee members at their first committee meeting to identify one reading topic per committee member. Committee members provide guidance for the student's readings around their topic. Students meet with each committee member throughout the semester to discuss the readings, ask questions, and clarify any aspects of their topics.

**EEMB 8104. Readings in Geosciences. (2 Hours)**

Designed to prepare PhD students with a concentration in geosciences for a career in their field by offering an opportunity to learn fundamental aspects of the discipline through readings. Each student works with their Northeastern committee members at their first committee meeting to identify one reading topic per committee member. Committee members provide guidance for the student's readings around their topic. Students meet with each committee member throughout the semester to discuss the readings, ask questions, and clarify any aspects of their topics.

**EEMB 8982. Readings. (1-4 Hours)**

Assigns students independent readings on selected topics in ecology, evolution, and marine biology. May be repeated without limit.

**EEMB 8984. Research. (1-4 Hours)**

Offers students an opportunity to conduct research. May be repeated without limit.

**EEMB 8986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**EEMB 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**EEMB 9990. Dissertation Term 1. (0 Hours)**

Offers theoretical and experimental research for the PhD degree.

**Prerequisite(s):** EEMB 9000 with a minimum grade of S

**EEMB 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** EEMB 9990 with a minimum grade of S

**EEMB 9996. Dissertation Continuation. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** EEMB 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Economics (ECON)

**ECON 1000. Economics at Northeastern. (1 Hour)**

Intended for freshmen in the College of Social Sciences and Humanities. Introduces freshmen to the liberal arts in general; familiarizes them with their major; helps them develop the academic skills necessary to succeed (analytical ability and critical thinking); provides grounding in the culture and values of the University community; and helps them develop interpersonal skills—in short, familiarizes students with all skills needed to become a successful university student.

**ECON 1115. Principles of Macroeconomics. (4 Hours)**

Introduces macroeconomic analysis. Topics include the flow of national income, economic growth and fluctuation, the role of money and banking, and monetary and fiscal policies. Emphasizes the development of conceptual tools to analyze the economic problems facing modern society, including long-run growth, unemployment, inflation, and inequality. Analyzes strengths and weaknesses of aggregate measures of economic activity, including how aggregation can hide underlying inequalities across racial, gender, and socioeconomic lines.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Societies/Institutions

**ECON 1116. Principles of Microeconomics. (4 Hours)**

Introduces microeconomics—a branch of economics that focuses on the interaction of consumers, firms, and governments in markets. Covers a basic theory of supply, demand, and competitive equilibrium. Presents several market structures and emphasizes different forms of market and government failure. Explores the compatibility of efficiency and equity in a variety of areas, such as social justice, sustainability, and income distribution. Offers students an opportunity to become familiar with the economic way of thinking, which provides a foundation for subsequent learning in economics.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Societies/Institutions

**ECON 1125. Recitation for ECON 1115. (0 Hours)**

Provides small-group discussion format to cover material in ECON 1115.

**ECON 1126. Recitation for ECON 1116. (0 Hours)**

Offers small-group discussion format to cover material in ECON 1116.

**ECON 1230. Healthcare and Medical Economics. (4 Hours)**

Enables students to recognize the relevance of economics to health and medical care and apply economic reasoning to understand health-related issues better; to understand the mechanism of healthcare delivery in the United States within broad social, political, and economic contexts; to explore the changing nature of health and medical care and its implications for medical practice, medical education and research, and health policy; and to analyze public policy in health and medical care from an economic perspective.

**ECON 1240. Economics of Crime. (4 Hours)**

Offers an overview of core issues specific to the economics of crime. Examines the social costs of crime, the determinants of criminal behavior, and the design of enforcement policies. Topics may include incarceration, policing, the deterrent effect of punishment, gun policy, cybercrime, drug policy, and racial bias within the criminal justice system. May consider social factors relating to education, poverty, family structure, and the environment.

**Attribute(s):** NUpath Societies/Institutions

**ECON 1245. Economics of Inequality. (4 Hours)**

Introduces inequality from an economic perspective. Studies how inequality relates to scarcity, appropriability, and inheritability. Discusses how taxation, economic growth, globalization, and technological progress affect inequality. Emphasizes the difference between inequality of economic outcomes and inequality of economic opportunity. Covers inequality in sectors such as housing, healthcare, labor market, and others. Discusses alternative empirical methods for measuring inequality, and presents economic policies designed to address it.

**ECON 1260. Contested Issues in the U.S. Economy. (4 Hours)**

Covers many of the contested economic issues that the United States faces as a nation—the size of government, the national debt, the war on drugs, national healthcare, taxation, and many more. An important social system in any society is the economic system—the allocation of scarce resources. In the large and complex economy of the United States, there is controversy over what goods and services are produced and how they are distributed. To understand the nature and causes of these issues requires a course where theory is a tool of analysis, not the focus. Economics is not value free. Attention is given to the role of ethics and how our moral values shape policy. Course topics vary from semester to semester.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**ECON 1292. Economic History of the Middle East. (4 Hours)**

Provides an historical account of the economies of the Middle East from the sixth century C.E. to the present. Conceives of the area between the Nile and Oxus as forming the core of the Middle East; besides the core, the region includes Turkey and North Africa. Identifies the major economic and demographic trends in the region, or segments of the region, to examine the ecological bases of the economies and the connection between political history and the economic trends and to understand the ways in which economies of the region articulated with other major economic regions including Europe, West Africa, and the economies of the Indian Ocean. Studies the systems of government and laws, agriculture, commerce, and manufacturing.

**Attribute(s):** NUpath Difference/Diversity

**ECON 1711. Economics of Sustainability. (4 Hours)**

Studies the significance of behavioral assumptions on economic outcomes and social norms, specifically as these relate to the perceived value of resources and the broader ecosystem. Explores the importance of economic concepts such as externalities and elasticity in relation to a market-driven economy, price, and consumption behavior. Through the use of elementary life cycle analysis, introduces both the definition and responsibilities of the rational agent as these relate to the establishment of sustainable outcomes. Offers students an opportunity to articulate the relationship between economic growth and climate change and reconcile the historical relationship between social values and sustainable outcomes.

**ECON 1915. Introductory Selected Topics in Macroeconomics. (4 Hours)**

Covers selected topics in the field of macroeconomics. The specific topic is chosen by the instructor. May be repeated up to three times.

**ECON 1916. Introductory Selected Topics in Microeconomics. (4 Hours)**

Covers selected topic matter in the field of microeconomics. The specific topic is chosen by the instructor. May be repeated up to three times.

**ECON 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ECON 2315. Macroeconomic Theory. (4 Hours)**

Presents several theoretical approaches to the study of macroeconomic dynamics in both the short and long run. Emphasizes the use of rigorous mathematical tools, such as calculus, to examine the major determinants of fluctuations in employment and price level, as well as the rate of economic growth. Explores theoretical models to evaluate the operation and impact of various macroeconomic policy tools. Discusses how macroeconomic performance relates to issues of social justice.

**Prerequisite(s):** ECON 1115 with a minimum grade of D- ; (MATH 1231 with a minimum grade of D- or MATH 1241 with a minimum grade of D- or MATH 1242 with a minimum grade of D- or MATH 1245 with a minimum grade of D- or MATH 1251 with a minimum grade of D- or MATH 1340 with a minimum grade of D- or MATH 1341 with a minimum grade of D- or MATH 1342 with a minimum grade of D- )

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Societies/Institutions

**ECON 2316. Microeconomic Theory. (4 Hours)**

Examines the behavior of consumers and firms under several different market structures, including monopoly, oligopoly, monopolistic competition, and perfect competition. Covers sources of market failure, such as public goods, externalities, and information asymmetry. Presents the key analytical tools economists apply to evaluate the welfare and distributional impacts of policies designed to improve market outcomes. Relies on calculus-based methods, offering an opportunity for students to extend their knowledge of microeconomics.

**Prerequisite(s):** ECON 1116 with a minimum grade of D- ; (MATH 1231 with a minimum grade of D- or MATH 1241 with a minimum grade of D- or MATH 1242 with a minimum grade of D- or MATH 1245 with a minimum grade of D- or MATH 1251 with a minimum grade of D- or MATH 1340 with a minimum grade of D- or MATH 1341 with a minimum grade of D- or MATH 1342 with a minimum grade of D- )

**Attribute(s):** NUpath Natural/Designed World

**ECON 2350. Statistics for Economists. (4 Hours)**

Presents statistical techniques used to analyze data in order to address issues related to economics and other social sciences. Explores different types of datasets, sampling, and data collection techniques. Discusses how to obtain sociodemographic data for different subpopulations based on gender, race, class, ethnicity, and other stratifications. Uses data visualization techniques to depict economic phenomena. Offers students an opportunity to compute and interpret summary statistics, conduct confidence interval estimation, hypothesis testing, and simple regression analysis. Computer applications are an integral part of the course.

**Prerequisite(s):** (CS 1100 (may be taken concurrently) with a minimum grade of D- or CS 2500 (may be taken concurrently) with a minimum grade of D- or DS 2000 (may be taken concurrently) with a minimum grade of D- or MISM 2510 (may be taken concurrently) with a minimum grade of D- )

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**ECON 2560. Applied Econometrics. (4 Hours)**

Introduces the techniques of regression analysis useful to address relevant questions in economics and related subjects. Covers the foundations of multivariate regression analysis, including potential issues such as heteroskedasticity, multicollinearity, omitted variable bias, and model specification. Additional topics may include instrumental variables, panel data, discrete choice models, and time-series analysis. Utilizes regression software (e.g., Stata, R, Python) throughout the course to analyze real-world data. Writing an applied econometrics paper is an integral part of the course.

**Prerequisite(s):** (CS 1100 with a minimum grade of D- or CS 2500 with a minimum grade of D- or DS 2000 with a minimum grade of D- or MISM 2510 with a minimum grade of D- ); ECON 1115 with a minimum grade of D- ; ECON 1116 with a minimum grade of D- ; (ECON 2350 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or INSH 3102 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or POLS 2400 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C or ENGL 1102 with a minimum grade of C ); (MATH 1231 with a minimum grade of D- or MATH 1241 with a minimum grade of D- or MATH 1245 with a minimum grade of D- or MATH 1251 with a minimum grade of D- or MATH 1340 with a minimum grade of D- or MATH 1341 with a minimum grade of D- )

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Writing Intensive

**ECON 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Prerequisite(s):** ECON 1115 with a minimum grade of D- ; ECON 1116 with a minimum grade of D-

**ECON 3255. Economics of Financial Market Structure. (4 Hours)**

Examines global financial markets such as U.S. equities markets, stock options exchange markets, and the Treasury debt market. Explores financial instruments used in each of these markets such as debt and equity instruments, futures and options, credit default swaps, and interest rate swaps. Analyzes government regulation and shortcomings of these markets. Discusses policies for the potential improvement of financial markets. Offers students an opportunity to develop skills in the use of current financial market technologies and instruments.

**Prerequisite(s):** ECON 1116 with a minimum grade of D-

**ECON 3290. History of the Global Economy. (4 Hours)**

Covers ideological biases in economics; the extent of global disparities around 1800; evolution of global disparities since 1800; evolution of international integration and international trading and monetary regimes, 1800–2000; theories explaining global disparities: classical, neoclassical, Marxian, neo-Marxian, and structuralist; import-substituting industrialization: Latin America, Asia, and Africa; international debt crises: nineteenth and twentieth centuries; the new global regime; structural adjustment: GATT (General Agreement on Tariffs and Trade) and WTO (World Trade Organization); and socialist interlude: a socialist experience and transition to capitalism.

**Prerequisite(s):** ECON 1116 with a minimum grade of D- or ECON 1115 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**ECON 3291. Development Economics. (4 Hours)**

Explores social and economic development around the world. Topics include income, poverty, inequality, human development, geography, growth, impact evaluation, health, education, financial markets, trade, and gender inequality. Analyzes four key elements of economic development: income, poverty, inequality, and human development. Offers students an opportunity to understand the determinants of economic growth. Focuses on major policy issues concerning health, education, credit, savings, gender differences, and globalization. Studies which interventions worked and which did not. Exposes students to readings and perspectives from several academic disciplines. Emphasizes one unifying methodological theme: the usefulness of empirical economic tools in assessing the arguments presented in debates about development.

**Prerequisite(s):** ECON 1116 with a minimum grade of D- ; (ECON 2350 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or POLS 2400 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- )

**Attribute(s):** NUpath Societies/Institutions

**ECON 3404. International Food Policy. (4 Hours)**

Offers an overview of the rationale for and types of food policies in developing countries. Uses a food systems approach to cover economic and political dimensions of food policy. Emphasizes food security, nutrition, poverty alleviation, and environmental issues. Discusses and analyzes the dynamics of change in the role of government; food value chains; and institutions and governance and their implications for local, regional, and global food systems.

**Prerequisite(s):** ECON 1116 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**ECON 3405. A Critique of Capitalism. (4 Hours)**

Examines the origins, workings, successes, and failures of capitalism, defined as an economic system where capital is mostly privately owned and markets generally solve economic problems. Examines, in addition, several variants of private-ownership economies including slavery, feudalism, land-tenancy, putting-out system, and self-employment. Also examines some alternatives to capitalism, such as command socialism, market socialism, worker-ownership of capital, cooperatives, Islamic economy, and Christian economy.

**Prerequisite(s):** ECON 1116 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**ECON 3410. Labor Economics. (4 Hours)**

Emphasizes an economic analysis of the labor market, the labor force, and wages and earnings. Explores the differences that have existed and currently exist in the labor market with regard to race, ethnicity, and gender and the theories behind why they have existed and continue to exist. Covers supply, development, and efficient use of human resources; demand for labor by businesses and industries; wage inequality and its determinants; changing occupational and industrial structure; nature, causes, and incidence of unemployment; economic impact of unions; and influence of related labor-market institutions and relevant public policies including minimum wages, wage subsidies, and earned-income tax credits; health and safety regulations (OSHA); and antidiscrimination and affirmative action policies and programs.

**Prerequisite(s):** ECON 1116 with a minimum grade of D- ; (ECON 2350 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or POLS 2400 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- )

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**ECON 3413. Health Economics and Healthcare Policy. (4 Hours)**

Studies functional skills economists use in health policy analysis, how to apply economic models, and the tools of data and statistical analysis, with the goal of answering health policy questions. Topics include individual health decisions, health insurance coverage and access to care, the behavior of hospitals and health insurers, the Medicare and Medicaid programs, prescription drug prices, innovation/RD in the pharmaceutical sector, and topics in public health. Offers students an opportunity to develop the knowledge and tools required to understand, discuss, and provide informed perspective on national policy debates, such as the Affordable Care Act, rising healthcare prices and lack of affordability, the benefits and drawbacks of a national single-payer health insurance program, and public health topics such as rising mortality and prescription opioid and heroin abuse.

**Prerequisite(s):** ECON 1116 with a minimum grade of D- ; (ECON 2350 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or POLS 2400 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- )

**ECON 3416. Behavioral Economics. (4 Hours)**

Questions assumptions made in standard microeconomic utility-driven models, using insights from psychology and other social sciences. Examines behavior that departs from these assumptions and tests theories with data. Incorporates empirical evidence from a wide range of fields, including development economics, health economics, labor economics, industrial organization, and finance. Topics include deviations from standard models in terms of preferences (present bias, reference dependence, and social preferences); beliefs (projection bias); and decision making (cognition, attention, and framing); as well as market and policy reactions to such deviations.

**Prerequisite(s):** ECON 1116 with a minimum grade of D- ; (ECON 2350 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or POLS 2400 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- )

**ECON 3420. Urban Economic Issues. (4 Hours)**

Studies urban growth and development, focusing on economic analysis of selected urban problems such as housing, poverty, transportation, education, health, crime, and the urban environment. Discusses public policies related to such problems.

**Prerequisite(s):** ECON 1116 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**ECON 3423. Environmental Economics. (4 Hours)**

Applies the tools of economics to environmental issues. Explores taxonomy of environmental effects; externalities; the commons problem; taxation, regulations, marketable permits, and property rights as a solution; measuring benefits of cleaner air and water, noise abatement, and recreational areas; global issues including tropical deforestation and acid rain; and the relevance of economics to the environmental debate.

**Prerequisite(s):** ECON 1116 with a minimum grade of D-

**ECON 3424. Law and Economics. (4 Hours)**

Introduces students to the economic approach to law. Focuses on several different bodies of law, including torts, property, contracts, and crime. Specific applications may consider additional areas, including those related to health and safety, the environment, and the legal services industry. Relies on economic models to examine the incentives created by various rules and considers the implications for social welfare. Covers select cases to highlight their economic importance. Examines the economic logic underlying the evolution of the common law.

**Prerequisite(s):** ECON 1116 with a minimum grade of D-

**Attribute(s):** NUpath Formal/Quant Reasoning, NUpath Societies/Institutions

**ECON 3425. Energy Economics. (4 Hours)**

Introduces theoretical and empirical perspectives on energy demand and energy supply. Energy is vital to modern economies. Emphasizes the role markets play in determining how to use energy and its sources and the scope for public policy to address market imperfections. Discusses oil, natural gas, coal, nuclear power, and renewable energy (such as hydro-, wind, and solar power). Covers the public policy issues around greenhouse gas emissions and energy security.

**Prerequisite(s):** ECON 1116 with a minimum grade of D-

**ECON 3440. Public Finance. (4 Hours)**

Presents an overview of the economics of government and the role of public policy. Develops guidelines to determine which economic activities are best performed by government and which are not. Also examines the impact of tax policies on efficiency, economic growth, and equity. Topics include market failures, public choice, the personal income tax, the corporate tax, sales tax, and taxation of capital and wealth, and options for reform of the tax structure. Major spending programs such as social security and education and healthcare are analyzed.

**Prerequisite(s):** ECON 1116 with a minimum grade of D-

**ECON 3442. Money and Banking. (4 Hours)**

Covers the nature and functions of money, credit, and financial markets in the modern international economy. Analyzes financial markets and institutions, central banking, and the effects of interest and foreign exchange rates on the real economy.

**Prerequisite(s):** ECON 1115 with a minimum grade of D-

**ECON 3460. Managerial Economics. (4 Hours)**

Explores the application of economic principles to the solution of managerial decision-making problems in areas such as demand estimation, cost estimation and control, pricing and marketing strategies, employee incentives, financing of capital investments, and responses to government regulation and taxation. Case studies and simulation models are typically used as pedagogical tools.

**Prerequisite(s):** ECON 1116 with a minimum grade of D-

**ECON 3462. Bubbles, Busts, and Bailouts: Market and Regulatory Failures in the Financial Crisis. (4 Hours)**

Investigates economic and financial bubbles together with the busts and bailouts that usually follow. Analyzes how and why bubbles form in markets such as housing and stocks, emphasizing the financial crisis of 2007–2008 but covers others as well. Also examines the lasting effects on markets and the economy from the collapse of such bubbles and the need for bailouts and other policies that are often used. Applies a range of perspectives to identify the market failures and regulatory failures that can cause bubbles—failures of assumptions about information, about incentives, and about oversight. Includes perspectives from microeconomics, behavioral economics, finance, and public policy.

**Prerequisite(s):** ECON 1116 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**ECON 3470. American Economic History. (4 Hours)**

Covers the economic history of the United States from the colonial period to the present. Includes studies of the development of major economic institutions and the effects of technological change. Examines economic reasons for the spread of an industrial market economy in the nineteenth century and the successes and failures of this economy in the twentieth century.

**Prerequisite(s):** ECON 1115 with a minimum grade of D- ; (ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C )

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**ECON 3481. Economics of Sports. (4 Hours)**

Investigates what economics has to say about sports as an economic activity: what tools of economic analysis apply to sports, whether sports require different economic tools, what the evidence has to say about key questions. Focuses on professional team sports, although some attention is paid to college sports and to individual professional sports.

**Prerequisite(s):** ECON 1116 with a minimum grade of D-

**ECON 3490. Public Choice Economics. (4 Hours)**

Studies public choice economics—the scientific analysis of government behavior—and is divided into two parts: institutional political economy and social choice theory. Public choice economics applies this neoclassical economic analysis to political issues such as rent seeking, tax reform, logrolling, voting behavior, the function of government, the intersection between public and private interests, and federalism. The point of departure from political science is that economists have based this analysis on the assumption that utility functions do not change once a person enters the realm of public service and that the argument of their utility functions is still their own self-interest and not the interest of the social system in which they operate.

**Prerequisite(s):** ECON 1115 with a minimum grade of D- ; ECON 1116 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**ECON 3520. History of Economic Thought. (4 Hours)**

Traces the evolution of Western economic thought. Covers several important periods and schools of economic thought including mercantilism, physiocracy, classical, Marxist, neoclassical, and Keynesian. Emphasizes the relationship between historical changes in society and economic thought, focusing on changes in the types of questions economists ask and the analytical tools they use.

**Prerequisite(s):** ECON 1115 with a minimum grade of D- ; ECON 1116 with a minimum grade of D- ; (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**ECON 3635. International Economics. (4 Hours)**

Covers Ricardian and neoclassical theories of trade; trade policies; tariffs, quotas, voluntary export restraints, and customs union; global trade regime; GATT (General Agreement on Tariffs and Trade) and WTO (World Trade Organization); balance-of-payments accounts; foreign exchange markets; monetary and portfolio balance approaches to external balance; fixed or flexible exchange rates; and international monetary system.

**Prerequisite(s):** ECON 1115 with a minimum grade of D- ; ECON 1116 with a minimum grade of D-

**ECON 3711. Economics of Race. (4 Hours)**

Addresses economic issues related to race, including the persistence of racial discrimination. Studies the social construction of race and the use of this construction to legitimize exploitation. Covers the economic modeling of discrimination and segregation, as well as the effect of these societal attributes on economic outcomes, and the complexity of racial equity and equality specific to reparations. Course materials rely on published research, film, and other media.

**Prerequisite(s):** ECON 1116 with a minimum grade of D-

**ECON 3915. Intermediate Selected Topics in Macroeconomics. (4 Hours)**

Covers selected topic matter in the field of macroeconomics. The specific topic is chosen by the instructor. May be repeated up to five times.

**Prerequisite(s):** ECON 1115 with a minimum grade of D-

**ECON 3916. Intermediate Selected Topics in Microeconomics. (4 Hours)**

Covers selected topic matter in the field of microeconomics. The specific topic is chosen by the instructor. May be repeated up to five times.

**Prerequisite(s):** ECON 1116 with a minimum grade of D-

**ECON 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Prerequisite(s):** ECON 2315 with a minimum grade of D- ; ECON 2316 with a minimum grade of D-

**ECON 4637. Monetary and Fiscal Policy. (4 Hours)**

Examines how government policies affect the macroeconomy both in theory and practice. Explores the trade-offs governments face when fiscal policy is used to smooth business cycles and address issues of equity. Covers models of monetary policy and how they are utilized by central banks to address business cycles. Key topics include fiscal and money multipliers, transmission mechanisms, nominal anchors, policy rules, and the role of expectations. While the central focus is on the United States, offers students an opportunity to examine fiscal and monetary policies of other nations.

**Prerequisite(s):** ECON 2315 with a minimum grade of D-

**ECON 4640. Financial Economics. (4 Hours)**

Introduces students to the theory of investments, including the principles of risk and return, the theory of portfolio selection, asset pricing models such as the capital asset pricing model (CAPM) and arbitrage pricing theory (APT), valuation of stocks, bond pricing and the term structure of interest rates, and options (what they are and how to use them). Geared toward nonbusiness majors who are interested in a rigorous course in finance.

**Prerequisite(s):** (ECON 2315 with a minimum grade of D- or ECON 2316 with a minimum grade of D- ); (ECON 2350 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or POLS 2400 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- )

**ECON 4680. Competition Policy and Regulation. (4 Hours)**

Presents an analytic framework and empirical study of how the structure of industries and the conduct of sellers affect performance. Includes examples and case studies from both the "old economy" and the "new economy." Examines antitrust as a public policy designed to promote better market performance.

**Prerequisite(s):** ECON 2316 with a minimum grade of D-

**ECON 4681. Information Economics and Game Theory. (4 Hours)**

Offers an advanced course on the economics of information, including moral hazard and adverse selection; game theory; and mechanism design. Formally considers alternative solution concepts, such as Nash equilibrium and rationalizability for simultaneous move and sequential move games under complete information about payoffs and preferences, as well as solution concepts, such as Bayesian-Nash equilibrium to analyze selection, screening, and incentives in games of incomplete or asymmetric information. Covers optimal incentives or mechanism design, including the optimal design of contracts, auctions, and other mechanisms. Prior exposure to game theory recommended.

**Prerequisite(s):** ECON 2316 with a minimum grade of D- ; (ECON 2350 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or POLS 2400 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- )

**Attribute(s):** NUpath Formal/Quant Reasoning, NUpath Societies/Institutions

**ECON 4692. Senior Economics Seminar. (4 Hours)**

Incorporates aspects of real-world and academic experiences of students into an analytical context, enabling students to demonstrate their ability to apply economic concepts, methodology, and data to economic issues and problems of personal and philosophical significance.

**Prerequisite(s):** ECON 2315 with a minimum grade of D- ; ECON 2316 with a minimum grade of D- ; (ECON 2350 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or POLS 2400 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- )

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**ECON 4916. Advanced Selected Topics in Microeconomics. (4 Hours)**

Covers selected topic matter in the field of microeconomics. The specific topic is chosen by the instructor. May be repeated up to four times.

**Prerequisite(s):** ECON 2316 with a minimum grade of D-

**ECON 4965. Undergraduate Teaching Experience. (4 Hours)**

Offers an opportunity for qualified undergraduate students to serve as undergraduate teaching assistants. Requires various assignments closely directed by the assigned course instructor. These may include holding office hours, light grading, maintaining the records for the course, proctoring—but not solely administering—exams and quizzes, holding recitation/tutorial sessions, and (very) limited lecturing or leading class discussions. Requires minimum overall GPA of 3.333 and grade of A– or better in course assignment; permission to enroll is further subject to the availability of an appropriate course assignment and instructor.

**ECON 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated without limit.

**Prerequisite(s):** ECON 2315 with a minimum grade of D- ; ECON 2316 with a minimum grade of D- ; (ECON 2350 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or POLS 2400 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- )

**ECON 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** ECON 4970 with a minimum grade of D-

**ECON 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ECON 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**ECON 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May not be substituted for requirements leading to a BA or BS in economics. Requires approval of department chair. May be repeated without limit.

**ECON 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**ECON 4996. Experiential Education Directed Study. (4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major. Restricted to those students who are using the course to fulfill their experiential education requirement. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**ECON 4997. Senior Economics Thesis. (4 Hours)**

Offers students an opportunity to write and present a research project on a topic within the discipline of economics. Students identify a question derived from economic theory and conduct a review of relevant literature in economics and related fields, analyzing the question through a well-defined research methodology.

**Prerequisite(s):** ECON 2315 with a minimum grade of D- ; ECON 2316 with a minimum grade of D- ; ECON 2560 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**ECON 5105. Math and Statistics for Economists. (4 Hours)**

Offers an intensive study of the statistical methods and techniques and mathematical fundamentals necessary for quantitative economics. Statistical topics include descriptive statistics, probability theory, fundamentals of estimation and hypothesis testing, and regression and correlation analysis. Mathematical topics include linear algebra and differential and integral calculus. Computer applications are an integral part of the course.

**ECON 5110. Microeconomic Theory. (4 Hours)**

Presents a survey of microeconomic theory at the beginning graduate level. Topics include theories of the consumer, firm, and market (including input and output markets), welfare economics, and market failures. Includes applications of theory to public policy questions in such fields as industrial organization and public finance. Requires knowledge of undergraduate microeconomic theory.

**ECON 5120. Macroeconomic Theory. (4 Hours)**

Examines theories of the short-run determination of output, employment, and prices, and long-run economic growth. Presents alternative macroeconomic models. Also consists of applied case study analysis of the theoretical models presented in class.

**ECON 5140. Applied Econometrics. (4 Hours)**

Offers an intensive study of econometric techniques applied to cross-section, time-series, and panel data. Applies the fundamentals of econometrics to analyzing structural economic models, forecasting, and policy analysis. Computer applications and an empirical research project are an integral part of the course.

**Prerequisite(s):** ECON 5105 with a minimum grade of C- or ECON 6105 with a minimum grade of C-

**ECON 5200. Topics in Applied Economics. (4 Hours)**

Presents an application of microeconomic and macroeconomic theory, as well as quantitative methods, to a variety of social issues, both domestic and international. May be repeated without limit where topics are unique.

**ECON 5210. Machine Learning in Economics. (4 Hours)**

Offers an in-depth introduction to a broad range of machine learning concepts and methods. Addresses the growing importance of machine learning in fostering the development of new research topics. Uses algorithms to discover and explore data patterns and applies machine learning techniques to uncover variables to help answer economic questions. Covers assumptions that underlie machine learning methods and how they can be validated with economic data. Identifies appropriate and optimal machine learning models for economic datasets and compares machine learning methods with traditional economic models. Offers students an opportunity to develop practical machine learning skills from an economic perspective. Emphasizes practical and innovative empirical applications in research and business.

**Prerequisite(s):** ECON 5105 with a minimum grade of C- or ECON 5105 with a minimum grade of C- or ECON 6105 with a minimum grade of C-

**ECON 5220. Computational Finance and Financial Econometrics. (4 Hours)**

Covers many aspects of the contemporary quantitative finance toolkit. Uses standard econometrics to address empirical finance questions such as estimating stock betas and efficient market tests. Includes advanced econometrics for non-stationary data and limited dependent variables, with cointegration/statistical arbitrage applications and bankruptcy modeling; quantitative research and portfolio management techniques like factor portfolio sorts (including machine learning and Big Data); and quantitative techniques, such as Monte Carlo simulations, to value derivatives and for pricing exotic options.

**Prerequisite(s):** ECON 2560 with a minimum grade of C- or graduate program admission

**ECON 5291. Applied Development. (4 Hours)**

Focuses on major macroeconomics policy questions for developing countries in an open economy context. Approaches these policy issues from a political economy perspective on macroeconomics. Combines theoretical foundations with institutional analysis and empirical evidence. Begins by developing a macroeconomic framework to analyze short-term macroeconomic adjustment and concludes with long-term growth, emphasizing the effects of financial integration and capital account regulations on macroeconomic performance in developing countries. Empirical data and country experiences help assess the validity of theoretical propositions and explain the complexity of development trajectories. Requires previous coursework in macroeconomic theory.

**ECON 5292. Gender and Development Economics. (4 Hours)**

Examines topics at the intersection of women's empowerment and economic development from an economic perspective. Introduces potential explanations for the gender inequalities in the context of developing countries as well as the role of public policy in addressing such disparities. Studies microeconomics topics such as education gaps, fertility, family planning, HIV/AIDS, marriage dynamics and intrahousehold allocation of resources, female labor outcomes and migration, as well as conflict and domestic violence. Offers students an opportunity to apply basic economic theory associated with each topic as well as the research methodologies used in recent empirical papers. Students with an econometrics background have a better understanding of the empirical papers. Requires previous course work in microeconomic theory and in statistics.

**ECON 5293. Agriculture and Development Policy. (4 Hours)**

Reviews main theories and empirical facts on the role of agriculture in economic development. Topics include population dynamics, agricultural productivity and growth, poverty alleviation, and future issues in agricultural development. Focuses on the analysis and application of policy solutions. Designed to help develop practical professional skills for application in the global development policy arena.

**Prerequisite(s):** ((ECON 2315 with a minimum grade of B or ECON 2316 with a minimum grade of B ); ECON 2560 with a minimum grade of D- ) or graduate program admission

**ECON 5650. Economic Growth and Applications. (4 Hours)**

Offers an in-depth analysis of models of economic growth and their empirical applications. Analyzes the process and mechanics of economic growth, technological change, and sources of income and growth differences across countries. Includes the role of technology, population dynamics, institutions, geography, and culture. Discusses alternative growth strategies in the context of income inequality and natural resource constraints. Requires previous coursework in macroeconomic theory.

**Prerequisite(s):** (ECON 2315 with a minimum grade of D- ; (ECON 2560 with a minimum grade of D- or ECON 3560 with a minimum grade of D- )) or graduate program admission

**ECON 6105. Advanced Mathematics and Statistics for Economists. (4 Hours)**

Covers the fundamental quantitative methods in economics. The first part of the course focuses on the role of mathematical models in economics, the applications of linear algebra, multivariate calculus, and static optimization theory. Studies statistics in the second part of the course, and offers students an opportunity to learn how to apply proper methods of empirical testing in economics. Additionally, introduces the statistical language R to equip students to complete most of the assignments in statistics. This is an advanced graduate course.

**ECON 6110. Advanced Microeconomic Theory. (4 Hours)**

Discusses consumer choice, classical demand theory, production, choice under uncertainty, competitive markets, and market power, which provide the theoretical foundation of more advanced topics that can be used as the basis to design empirical applications. Requires a strong background in linear algebra, multivariate calculus, and optimization theory for success in the course. A good undergraduate intermediate-level microeconomic theory course is also helpful. This is the first advanced graduate-level course on microeconomic theory for graduate students.

**ECON 6120. Advanced Macroeconomic Theory. (4 Hours)**

Develops basic models used by macroeconomists to study long-run economic growth with exogenous savings and endogenous saving decisions by optimizing households. Studies models incorporating endogenous technology improvements, including the model of increasing product variety and the model of Schumpeterian growth. In the second part of the course, basic models used by macroeconomist are developed to explain short-term fluctuations in aggregate economic variables. Develops a simple real business cycle model, which is subsequently enriched by relaxing assumptions of perfect competition on the production side and monetary neutrality. This is the first advanced graduate-level course introducing modern theories of the aggregate economy.

**ECON 6140. Advanced Applied Econometrics. (4 Hours)**

Offers students an opportunity to obtain the theoretical tools, computer skills, and experience using econometrics needed to appreciate and do high-quality applied research in economics. Emphasizes understanding how the properties of estimators can be found and their implications for applied research. Introduces the programming language Python, which is integrated into the course. Focuses on methods that are most useful in microeconomic analysis, including classical linear regressions, Gauss-Markov theorem and hypothesis testing, endogeneity, instrumental variable estimation and causality analysis, heteroskedasticity and serial correlations, nonlinearity, panel data methods, difference-in-difference, and regression discontinuity. This is the first advanced graduate-level course on econometrics.

**Prerequisite(s):** ECON 5105 with a minimum grade of C- or ECON 5105 with a minimum grade of C- or ECON 6105 with a minimum grade of C-

**ECON 6232. Designing Global Economic and Social Policy. (4 Hours)**

Examines economic challenges facing developing nations including poverty, inequality, low productivity, and limited access to human capital. Presents insights into theories like neoclassical growth models and dependency theory on spurring development. Explores policy options to promote growth such as increasing access to safety nets, human capital, and labor force participation. Offers students an opportunity to analyze data; evaluate policies to systematically understand developing world economic issues; and identify evidence-based, sustainable solutions tailored to individual countries' challenges.

**ECON 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**ECON 6955. Co-op Work Experience Abroad - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**ECON 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ECON 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated twice.

**ECON 6965. Co-op Work Experience Abroad. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated without limit.

**ECON 7200. Topics in Applied Economics. (4 Hours)**

Presents an application of microeconomic and macroeconomic theory, as well as quantitative methods, to a variety of social issues, both domestic and international. May be repeated without limit.

**ECON 7240. Workshop in Applied Econometrics. (4 Hours)**

Presents an intensive, hands-on application of econometrics to research problems in economics, using current econometric software packages. Uses both cross-section and time-series techniques and applies them to different areas of economics such as global economics, labor economics, urban economics, public finance, policy evaluation, and so on. Expects students to complete a written applied econometrics project and present the results to the class.

**Prerequisite(s):** ECON 5140 with a minimum grade of C- or ECON 5140 with a minimum grade of C- or ECON 6140 with a minimum grade of C-

**ECON 7250. International Economic Development. (4 Hours)**

Covers leading research topics in development economics, with a particular focus on patterns of global inequality and globalization, effects of trade policy on labor market adjustment, gender and development, education and health, long-term effects of institutions, commodity price dynamics, and Dutch disease. Course objectives include exploring the cutting-edge literature emerging on these topics and improving understanding of the most recent empirical methods used in the literature. Offers students an opportunity to learn how to apply econometric techniques to particular research questions while evaluating advantages and disadvantages of using different approaches and to demonstrate understanding of difference-in-differences analysis, instrumental variables, randomized evaluation, regression discontinuity, and structural vector autoregressive models. Students critically assess the limitations of these methods.

**ECON 7251. International Finance. (4 Hours)**

Introduces students to international finance and equips them with tools and methods to study and analyze international economic issues and problems. Topics include the foreign exchange market, balance of payments, international investment and banking, monetary and fiscal policy in an open economy, economic integration and monetary unification, the international monetary system, and optimum currency areas. Each student is required to write a short paper on a current problem in international finance.

**ECON 7266. Economics of Government. (4 Hours)**

Presents an overview of the economics of government and the role of public policy. Develops guidelines to determine which economic activities are best performed by government and which are not. Topics include public choice, public goods, externalities, public enterprise, and efficiency and equity effects of alternative tax systems.

**Prerequisite(s):** ECON 5110 with a minimum grade of C- or ECON 5110 with a minimum grade of C- or ECON 6110 with a minimum grade of C-

**ECON 7710. Microeconomic Theory 2. (4 Hours)**

Continues ECON 6110, building on its theories. Topics include game theory, economics of information, incentive theory, welfare economics, general equilibrium, and social choice theory.

**Prerequisite(s):** ECON 6110 with a minimum grade of B- or ECON 6110 with a minimum grade of B-

**ECON 7720. Macroeconomic Theory 2. (4 Hours)**

Continues ECON 6120. Offers an advanced course in macroeconomic analysis where economic theory and econometric evidence are brought together to explain economic events and changes at the macro level including economic growth, changes in unemployment and inflation rates, and business cycles. Topics include the Solow growth model, overlapping-generations models, research and development models of growth, real-business-cycle theory, Keynesian theories of economic fluctuations, microfoundations, consumption, investment, unemployment, inflation and monetary theory, and budget deficits and fiscal policy.

**Prerequisite(s):** ECON 6120 with a minimum grade of B- or ECON 6120 with a minimum grade of B-

**ECON 7740. Applied Econometrics 2. (4 Hours)**

Continues ECON 6140. Extends students' understanding of econometrics beyond the topics covered in the earlier course. Students develop and complete an econometric research project using methods covered. Topics include models with multiple equations, nonlinear regression models, asymptotic theory, maximum likelihood, discrete choice models, limited dependent variables and duration models, panel data, regression models for time-series data, and unit roots and cointegration.

**Prerequisite(s):** ECON 6140 with a minimum grade of B- or ECON 6140 with a minimum grade of B-

**ECON 7751. Development Economics. (4 Hours)**

Focuses on contemporary research questions and econometric methods in development economics. Includes a rigorous introduction to core microeconomic issues in economic development, focusing on both key theoretical contributions and empirical applications, to understand why some countries are poor and how markets function differently in poor economies. Examines and utilizes detailed survey data of the world's poor and scientifically evaluates policies and their effectiveness. Requires a solid understanding of how to read and interpret statistics. Topics include poverty and poverty traps, behavioral economics, savings, health, credit, networks, social norms, and the role of the public sector. Covers both seminal and leading contemporary economic research.

**Prerequisite(s):** ECON 5110 with a minimum grade of B or ECON 6110 with a minimum grade of B or PPUA 6502 with a minimum grade of B

**ECON 7763. Labor Market Analysis. (4 Hours)**

Offers a theoretical and methodological survey of the field of neoclassical labor market analysis at the PhD level. Topics include the supply of labor from the perspective of the individual and the family, human capital, the demand for labor, market equilibrium, and the determination and distribution of wages and earnings. Other topics that may be included are unions, unemployment, labor mobility, alternative models of labor markets, labor productivity and growth, and income distribution and poverty.

**Prerequisite(s):** ECON 7710 with a minimum grade of C- ; ECON 7740 (may be taken concurrently) with a minimum grade of C-

**ECON 7764. Topics in Labor Economics. (4 Hours)**

Covers the theoretical and empirical issues surrounding current topics in the area of labor economics. Topics may vary each time the course is offered and may include discrimination, efficiency wage theory, labor legislation, life cycle analysis, and the use of microdata (panel studies, search behavior, intergenerational earnings mobility, and employment and training policies).

**Prerequisite(s):** ECON 7763 with a minimum grade of C-

**ECON 7771. Framework of Industrial Organization. (4 Hours)**

Sets out the analytical framework of industrial organization economics—the basis and method for evaluating the performance of markets and firms and for prescribing policies for improvement. Topics include size and structure of firms, market concentration, pricing in oligopoly and other markets, entry and entry deterrence strategies, and advertising and product strategies. Each of these topics is examined using a range of tools including microeconomic theory, game theory, and statistical analysis.

**Prerequisite(s):** ECON 7710 with a minimum grade of B- ; ECON 7740 with a minimum grade of B-

**ECON 7772. Public Policy Toward Business. (4 Hours)**

Covers the three major facets of public policy toward business: antitrust, regulation, and privatization. Demonstrates how economic theory and evidence are brought to bear on practical questions of market failure and policies to remedy such failure. Topics include mergers, collusion and facilitating practices, predatory conduct, cost of service regulation, price caps and incentive regulation, deregulation, and public enterprise vs. privatization. Policies are analyzed for their rationale, techniques for implementation, and effects as measure in the context of actual experience in the United States and other countries.

**Prerequisite(s):** ECON 7771 with a minimum grade of C-

**ECON 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ECON 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May not be substituted for requirements leading to a BA or BS in economics. May be repeated without limit.

**ECON 7990. Thesis. (1-4 Hours)**

Provides thesis supervision by members of the department. May be repeated without limit.

**ECON 8550. Internship In Economics. (1-4 Hours)**

Comprises academic credit for internship work in economics. May be repeated without limit.

**ECON 8960. Exam Preparation—Doctoral. (0 Hours)**

Provides students with the opportunity to prepare for the qualifying exam during the semester in which they are registered for this course. Registration in this course constitutes full-time status. May be repeated three times.

**ECON 8986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**ECON 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**ECON 9986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**ECON 9990. Dissertation Term 1. (0 Hours)**

First of two consecutive semesters to meet the residency requirement of the doctoral program.

**Prerequisite(s):** ECON 9000 with a minimum grade of S

**ECON 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** ECON 9990 with a minimum grade of S

**ECON 9996. Dissertation Continuation. (0 Hours)**

Requires registration for those students who have completed the doctoral program's residency requirement, but who have not yet completed the dissertation.

**Prerequisite(s):** ECON 9991 with a minimum grade of S or Dissertation Check with a score of REQ

**Economics - CPS (ECN)****ECN 1100. Principles of Microeconomics. (3 Hours)**

Focuses on the development of the basic theory of supply and demand and market prices, as well as competition and monopoly and income distribution. Applies economic principles to selected problems such as poverty, pollution, and international trade.

**ECN 1200. Principles of Macroeconomics. (3 Hours)**

Introduces macroeconomics, the study of the economy as a whole. Macroeconomics applies the basic principles of economics to whole economic systems and the relationships among sectors of the economy. Topics include unemployment, inflation, national income and employment theory, government expenditures and taxation, the role of the banking system, and monetary and fiscal policies. Emphasizes the development of conceptual tools to analyze the economic problems facing modern society.

**Attribute(s):** NUpath Societies/Institutions

**ECN 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ECN 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ECN 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ECN 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Economics - CPS Specialty (ECNM)****ECNM 1115. Principles of Macroeconomics. (4 Hours)**

Introduces macroeconomic analysis. Topics include the flow of national income, economics growth and fluctuation, the role of money and banking, and monetary and fiscal policies. Emphasizes the development of conceptual tools to analyze the economic problems facing modern society.

**ECNM 1116. Principles of Microeconomics. (4 Hours)**

Focuses on development of basic theory of demand, supply, and market price. Explores applications to selected microeconomic problems, such as basic monopoly and competition, and other issues that relate to the role of the pricing system in resource allocation and income distribution.

**Education (EDUC)****EDUC 1111. Education in the Community. (4 Hours)**

Considers the unique contributions of community, family, and public schools to education in the United States today. Uses classroom and field-based activities to provide historical and social contexts of public education. Encourages students to reflect on their own prior education, to learn from persons active in the education community, and to consider their future roles as educators.

**Attribute(s):** NUpath Difference/Diversity, NUpath Integration Experience, NUpath Societies/Institutions

**EDUC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EDUC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EDUC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EDUC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EDUC 5503. Culture, Equity, Power, and Influence. (4 Hours)**

Examines the broad construct of culture and explores how these characteristics impact personal identity, access to education, social mobility, power, and influence. Explores educational institutions as cultural systems and questions concepts at the heart of personal and professional interactions in teaching, learning, curriculum, and administration. Expects students to participate in reflective discussion and begin to explore their own feelings and experience with culture; to develop competencies spanning cultural and international boundaries; to prepare to be more effective in diverse settings; and to influence and advocate for systemic change.

**EDUC 5504. Child and Adolescent Development, Learning, and Teaching. (4 Hours)**

Surveys contemporary educational theory of human learning and accomplished teaching. Offers students an opportunity to develop a working understanding of teaching and learning as they occur in different types of schools and community settings. Investigates how children and adolescents learn, acquire knowledge, and make sense of their experience, as well as theories of teaching or pedagogy—how best to teach for understanding and learning achievement.

**Prerequisite(s):** EDUC 1111 with a minimum grade of D-

**EDUC 5570. Inclusion, Equity, and Diversity. (4 Hours)**

Addresses the range of learning needs of special education legislation, as well as the politics of who is identified and why. Examines students' own attitudes about teaching children with learning disabilities. Offers students an opportunity to develop skills and strategies for identifying and teaching learning-disabled children. Requires graduate students to demonstrate advanced levels of study and research.

**Prerequisite(s):** EDUC 1111 with a minimum grade of D-

## Education - CPS (EDU)

### **EDU 5051. Culture, Equity, Power, and Influence. (3 Hours)**

Examines the broad construct of culture and explores how these characteristics impact personal identity, access to education, social mobility, power, and influence. Explores educational institutions as cultural systems and questions concepts at the heart of personal and professional interactions in teaching, learning, curriculum, and administration. Expects students to participate in reflective discussion and begin the personal exploration of their own feelings and experience with culture; to develop competencies spanning cultural and international boundaries; to prepare to be more effective in diverse settings; and to influence and advocate for systemic change.

### **EDU 5086. Foundations of Literacy Development and Instruction. (3 Hours)**

Introduces fundamental theoretical and practical instructional principles of developing reading, writing, and language arts, grounded in research on cognitive development and language acquisition, and informed by political and sociocultural perspectives. An integrated language model suggests that reading, writing, and thinking be viewed as interrelated, critical processes for exploring and responding to the world. Offers students an opportunity to acquire foundational knowledge of materials, instructional strategies, and assessment tools that support developing literacy and engaging learners.

### **EDU 5101. Critical Issues in Education: Past and Present. (2 Hours)**

Examines the historical, political, economic, and societal roles of schools while interrogating educational policies, inequities, and controversies that impact K-12 education, as well as the classroom and community opportunities for teachers to effect change. Educational experiences and outcomes in the United States are shaped by existing systems and institutional structures.

### **EDU 5102. Reflection, Community Engagement, and Agency in Education. (2 Hours)**

Introduces the facets of reflective practice beginning with a dispositional self-assessment to ground an exploration of culturally responsive teaching, culturally and linguistically sustaining practices, and to cultivate an activist mindset. Includes a community-based field component to explore funds of knowledge within specific community contexts to in order to support the development of an asset view of students and families and empower an understanding of dynamic experiential teaching and learning.

### **EDU 5104. Child and Adolescent Development, Learning, and Teaching. (3 Hours)**

Surveys contemporary educational theory of human learning and accomplished teaching. Offers students an opportunity to develop a working understanding of teaching and learning as they occur in different types of schools and community settings. Investigates how children and adolescents learn, acquire knowledge, and make sense of their experience, as well as theories of teaching or pedagogy—how best to teach for understanding and learning achievement.

### **EDU 5107. Inclusion, Equity, and Diversity. (3 Hours)**

Addresses the range of learning needs of special education legislation, as well as the politics of who is identified and why. Examines students' own attitudes about teaching children with learning disabilities. Offers students an opportunity to develop skills and strategies for identifying and teaching learning-disabled children. Requires graduate students to demonstrate advanced levels of study and research.

### **EDU 6001. Experiential Learning Theory and Practice. (4 Hours)**

Offers experiential educators an opportunity to obtain the knowledge, skills, and competencies needed to design and facilitate engaging and meaningful learning experiences. Compares different theoretical foundations for how people learn through experience and how these theories are put into practice using different approaches for teaching through experiences including active learning, inquiry-based learning, service-learning, place-based learning, and project-based learning. Discusses the principles of deeper learning and how to support the development of deeper learning competencies through experiential learning.

### **EDU 6002. Culturally Responsive Experiential Teaching and Learning. (4 Hours)**

Offers experiential educators an opportunity to obtain the knowledge, skills, and competencies needed to design and facilitate engaging and meaningful student-centered learning experiences that meet the needs of a diverse range of learners. Explores the constructs of culture, equity, power, and positionality and how educators facilitate the learning of others, it is important to understand who we are and how our own learning experiences shape our practices and perspectives. Also explores how to facilitate social emotional growth, agency, and self-authorship in students through culturally responsive experiential learning.

**EDU 6003. Applied Research in Experiential Teaching and Learning. (4 Hours)**

Offers experiential educators an opportunity to obtain the knowledge, skills, and competencies needed to collect, analyze, and use data as evidence to inform best practices in experiential teaching and learning. Explores the limitations of current assessment and teaching practices, after which learners apply Mind, Brain, and Education (MBE) science, the Understanding by Design (UbD) framework to develop an Experiential Learning (EXL) plan for deeper learning at the classroom, school, or district level. Learners reflect on how the design thinking process can be used to improve the EXL plan through the collection of a mix of multimodal, formative, and summative data collected from a variety of stakeholders. Learners share their EXL plan with relevant stakeholders and incorporate feedback.

**EDU 6004. Leading Experiential Teaching and Learning. (4 Hours)**

Offers experiential educators an opportunity to obtain the knowledge, skills, and competencies needed to engage in leadership practices to negotiate challenges and opportunities associated with experiential teaching and learning by applying the different leadership frameworks. Explores how to lead successful professional development experiences and how to establish and support effective professional learning communities. Offers students an opportunity to learn how to lead efforts to engage with, leverage, and contribute to different networks dedicated to supporting experiential teaching and learning.

**EDU 6050. Education as an Advanced Field of Study. (5 Hours)**

Focuses on the critical evaluation, interpretation, and uses of published research in education as a field of study. Offers students an opportunity to explore the relationship between theory and practice and the changing nature of knowledge, to examine peer-reviewed research articles, to learn the "rules" and methods through which these scholarly works are developed, and to begin to apply research findings to real problems and issues in education. As part of this course, students use an ePortfolio as they begin to document their development as scholars, practitioners, and leaders in the field of education.

**EDU 6051. Introduction to Social Justice in Educational Settings. (4 Hours)**

Introduces the concepts of social justice, especially as they relate to educational access. Explores educational institutions as systems and questions how individuals can be agents of change in teaching, learning, curriculum, and administration. Offers students an opportunity to engage in reflective discussion and begin to explore their own feelings and experiences with social justice and development of cultural intelligence to prepare them to influence and advocate for systemic change.

**EDU 6064. Curriculum and Assessment. (4 Hours)**

Presents how curriculum, student performance, and assessment are currently practiced in a variety of school settings with a view toward changing current practice to meet future needs. Offers students an opportunity to learn how to become active players in creating or improving curriculum at the classroom level, the school, or within a whole school district and to be able to link curriculum and assessment directly to student achievement.

**Prerequisite(s):** EDU 6104 (may be taken concurrently) with a minimum grade of C- ; EDU 6107 (may be taken concurrently) with a minimum grade of C-

**EDU 6086. Foundations of Literacy Development and Instruction. (4 Hours)**

Introduces fundamental theoretical and practical instructional principles of developing reading, writing, and language arts, grounded in research on cognitive development and language acquisition, and informed by political and sociocultural perspectives. An integrated language model suggests that reading, writing, and thinking be viewed as interrelated, critical processes for exploring and responding to the world. Offers students an opportunity to acquire foundational knowledge of materials, instructional strategies, and assessment tools that support developing literacy and engaging learners.

**Prerequisite(s):** EDU 6104 (may be taken concurrently) with a minimum grade of C- ; EDU 6107 (may be taken concurrently) with a minimum grade of C-

**EDU 6101. Critical Issues in Education: Past and Present. (2 Hours)**

Examines the historical, political, economic, and societal roles of schools while interrogating educational policies, inequities, and controversies that impact K-12 education, as well as the classroom and community opportunities for teachers to effect change. Educational experiences and outcomes in the United States are shaped by existing systems and institutional structures.

**EDU 6102. Reflection, Community Engagement, and Agency in Education. (2 Hours)**

Introduces the facets of reflective practice beginning with a dispositional self-assessment to ground an exploration of culturally responsive teaching, culturally and linguistically sustaining practices, and to cultivate an activist mindset. Includes a community-based field component to explore funds of knowledge within specific community contexts to in order to support the development of an asset view of students and families and empower an understanding of dynamic experiential teaching and learning.

**EDU 6104. Child and Adolescent Development, Learning, and Teaching. (4 Hours)**

Surveys contemporary educational theory of human learning and accomplished teaching. Offers students an opportunity to develop a working understanding of teaching and learning as they occur in different types of schools and community settings. Investigates how children and adolescents learn, acquire knowledge, and make sense of their experience, as well as theories of teaching or pedagogy—how best to teach for understanding and learning achievement.

**EDU 6107. Inclusion, Equity, and Diversity. (4 Hours)**

Addresses the range of learning needs of special education legislation, as well as the politics of who is identified and why. Examines students' own attitudes about teaching children with learning disabilities. Offers students an opportunity to develop skills and strategies for identifying and teaching learning-disabled children. Requires graduate students to demonstrate advanced levels of study and research.

**EDU 6122. Teaching the Language Arts. (4 Hours)**

Offers secondary teachers an opportunity to develop competence and confidence working with diverse students, many of whom appear to read and write only when required to do so. Considers the design and practices of traditional English curricula at the middle and high school level and explores alternative syllabi and unit design as strategies for actively engaging students in the pursuit of meaning in reading and writing as they enhance their skills. Explores the role of research as well as interdisciplinary and collaborative approaches as they relate to curricula in English and the humanities. Requires graduate students to demonstrate advanced levels of study and research.

**Prerequisite(s):** EDU 6104 (may be taken concurrently) with a minimum grade of C- ; EDU 6107 (may be taken concurrently) with a minimum grade of C-

**EDU 6124. Teaching History and the Social Sciences. (4 Hours)**

Explores the intersecting disciplines of history and social studies, including geography, sociology, economics, political science, and history. Emphasizes the interrelatedness of disciplines and the emerging role of middle and high school students as citizens in their school, community, nation, and the world. Examines the challenge of covering all the material deemed essential by state and district curriculum frameworks, while helping one's students become problem solvers and critical thinkers in their analysis of social problems. Requires graduate students to demonstrate advanced levels of study and research.

**Prerequisite(s):** EDU 6104 (may be taken concurrently) with a minimum grade of C- ; EDU 6107 (may be taken concurrently) with a minimum grade of C-

**EDU 6127. Teaching Science. (4 Hours)**

Examines how the evolving nature of science—ideas, theories, concepts, and controversies—relates to diverse middle and high school students and how teachers can use experience-based, problem-centered approaches that engage the range of student learners and help them meet local and state learning goals. Identifies research possibilities within school contexts, both inside and outside the laboratory. Explores curricular frameworks and culturally relevant content to enable teachers to create a learning environment that supports inquiry and problem solving. Analyzes examples of excellent curriculum products, programs, assessments, and technology tools. Offers students an opportunity to develop a curriculum unit including assessment philosophy and practices. Requires graduate students to demonstrate advanced levels of study and research.

**Prerequisite(s):** EDU 6104 (may be taken concurrently) with a minimum grade of C- ; EDU 6107 (may be taken concurrently) with a minimum grade of C-

**EDU 6129. Teaching Mathematics. (4 Hours)**

Explores mathematics teaching methods that are research based, experienced based, and grounded in the contemporary theoretical frameworks influencing mathematics education. Emphasizes issues related to teaching math in an urban school, problem solving, communication, connections, and integrating technology, as well as issues of access and equity, assessment, and cross-content teaching strategies. Requires graduate students to demonstrate advanced levels of study and research.

**Prerequisite(s):** EDU 6104 (may be taken concurrently) with a minimum grade of C- ; EDU 6107 (may be taken concurrently) with a minimum grade of C-

**EDU 6154. Inquiry in the Sciences and Humanities. (4 Hours)**

Explores methods for enabling children in grades 1–6 to experience the dynamics of scientific investigation as they develop their abilities to make thoughtful observation and make meaning of the results of those observations. Examines methods and materials, pedagogies, and assessment strategies that foster integrated learning across the sciences, social sciences, and humanities.

**Prerequisite(s):** EDU 6104 (may be taken concurrently) with a minimum grade of C- ; EDU 6107 (may be taken concurrently) with a minimum grade of C-

**EDU 6155. Inquiry in Mathematics. (4 Hours)**

Explores methods for teaching mathematics in grades 1–6 that are research and experience based and grounded in the contemporary theoretical frameworks influencing mathematics education. Designed to increase students' knowledge of mathematics as it simultaneously explores the intrinsic nature of math and methods for relating it to children. Emphasizes approaches to teaching mathematics that engage diverse populations of children.

**Prerequisite(s):** EDU 6104 (may be taken concurrently) with a minimum grade of C- ; EDU 6107 (may be taken concurrently) with a minimum grade of C-

**EDU 6162. Language, Culture, and Literacy in Middle and High Schools. (4 Hours)**

Examines the interrelationships among language, culture, and identity and explores the implications of those relationships for effective teaching in middle schools and high schools. Considers issues of linguistic diversity within their broad sociopolitical and philosophical contexts, emphasizing how language discrimination functions within the context of other forms of systematic oppression in our society. Explores the processes of identity development in the context of schooling and literacy performance. Also examines methods of helping linguistically diverse students to develop their oral and written language abilities within a learning environment that draws upon and celebrates their native language abilities and traditions. Requires graduate students to demonstrate advanced levels of study and research.

**Prerequisite(s):** EDU 6104 (may be taken concurrently) with a minimum grade of C- ; EDU 6107 (may be taken concurrently) with a minimum grade of C-

**EDU 6183. Collaborative Strategies for Effective Classroom Management. (3 Hours)**

Explores best practices in classroom organization and behavior management. Topics range from developing student-centered classrooms, routines, and space to strategies for managing transitions, classroom dynamics, individual behaviors, and positive behavioral support systems. Offers participants an opportunity to think critically and plan for a collaborative and productive classroom learning community.

**EDU 6185. English-Language Learners in the General Education Classroom. (4 Hours)**

Designed to introduce K–12 general educators to skills that enable them to work more effectively with English language learners in their classrooms. Explores the history of bilingual education in the United States and other programs used to teach English language learners. Offers participants the opportunity to develop sheltered English instructional strategies to scaffold lessons that can be used in any classroom setting where English language learners are present. Offers participants an opportunity to plan Sheltered English Immersion (SEI) lessons in a Sheltered Instructional Observation Protocol (SIOP) template using the World-Class Instructional Development and Design English Language Development (WIDA ELD) Standards. This course meets DESE requirements for the Sheltered English Immersion (SEI) endorsement.

**EDU 6202. Faculty, Curriculum, and Academic Community. (4 Hours)**

Examines collaborative approaches to developing and improving both curriculum and the delivery of that curriculum. Faculty and curriculum are not only the core of an institution of higher education, they are also what make institutions of higher education unique from any other type of organization. Topics include academic structure and governance within the context of the wider university community in not-for profit and for-profit institutions. Examines faculty unions, academic freedom, tenure, and the increasing role of adjuncts. Assesses how administration, faculty, and staff interact in an integrated, collegial environment.

**Prerequisite(s):** EDU 6051 (may be taken concurrently) with a minimum grade of C- or EDU 6204 with a minimum grade of C-

**EDU 6204. The Foundations of Higher Education. (5 Hours)**

Offers students an opportunity to obtain a foundation to understand the structure, governance, and operations of institutions of higher education in the United States. Students examine peer-reviewed articles, study the rules and methods through which scholarly works are developed, and begin to apply research findings to real problems and issues in higher education. Through critical evaluation, interpretation, and uses of published research, assesses higher education's complex organizational structure. Examines how these constructs are subject to today's environmental, financial, technological, and competitive pressures; considers how higher education may implement innovation; and analyzes strategies for adaption. Offers students an opportunity to learn to use an ePortfolio to document their development as scholar-practitioners.

**EDU 6205. The Demographics of the New College Student. (4 Hours)**

Offers students an opportunity to understand the changing demographics of students who matriculate at higher education institutions, such as first-generation college students, veterans, international students, and adult learners. Explores strategies and theories for college student access and success.

**Prerequisite(s):** EDU 6051 with a minimum grade of C-

**EDU 6216. The College Student Experience. (4 Hours)**

Explores how various student development theories can be leveraged to positively impact learners' social and academic success in higher education.

**Prerequisite(s):** EDU 6205 (may be taken concurrently) with a minimum grade of C- or EDU 6447 (may be taken concurrently) with a minimum grade of C-

**EDU 6217. The History of Colleges and Universities. (4 Hours)**

Explores the historical origins of higher education in the United States, from the colonial era to the present. Focuses on an array of topics including liberal arts, graduate education, community colleges, historically black colleges and universities, Hispanic-serving institutions, study abroad, international students, online education, religious-affiliated institutions, and professional higher education associations.

**EDU 6218. Money Matters: Financial Management in Higher Education. (4 Hours)**

Offers students an opportunity to develop the practical skills and competencies necessary to build and manage budgets, advocate for and allocate both human/financial resources, and effectively articulate how strategic initiatives translate into budget requests. Linking theory to practice, successful students develop core financial management competencies while also being exposed to how colleges/universities approach critical fiduciary responsibilities. Developing both a conceptual and practical understanding of the financial management strategies employed within today's changing landscape of higher education is critical to professional success.

**Prerequisite(s):** EDU 6204 with a minimum grade of C-

**EDU 6219. Higher Education Law and Policy. (4 Hours)**

Offers an overview of the major aspects of the legal and political environments that impact institutions of higher education, ranging from access, affordability, readiness, and completion to gainful employment. Offers students an opportunity to learn multiple approaches for addressing these requirements and understanding and influencing policy development at all levels, both internal and external.

**Prerequisite(s):** EDU 6204 with a minimum grade of C- ; EDU 6217 with a minimum grade of C-

**EDU 6222. Contemporary Issues Capstone. (4 Hours)**

Offers students an opportunity to reflect on their development as scholars, practitioners, and leaders in the field of higher education. Students apply knowledge developed throughout the program to various contemporary issues in higher education. Requires students to demonstrate mastery of content through a significant project and present their final ePortfolios to showcase their work.

**Prerequisite(s):** EDU 6204 with a minimum grade of C- ; EDU 6217 with a minimum grade of C- ; EDU 6051 with a minimum grade of C- ; EDU 6205 with a minimum grade of C- ; EDU 6218 (may be taken concurrently) with a minimum grade of C- ; EDU 6234 (may be taken concurrently) with a minimum grade of C- ; EDU 6219 (may be taken concurrently) with a minimum grade of C-

**EDU 6224. Strategic Leadership in Enrollment Management. (4 Hours)**

Examines the multifold strategies in student enrollment including predictive analytics models, branding and marketing, access and affordability, and communication with internal and external constituents. Taught from a systems-thinking perspective.

**Prerequisite(s):** EDU 6050 with a minimum grade of C- or EDU 6204 with a minimum grade of C-

**EDU 6225. Capstone. (4 Hours)**

Offers students an opportunity to reflect on concentration-specific work, considering their development as scholars, practitioners, and leaders in the field of education. Requires students to demonstrate mastery of content through practicum or a significant project adapted to the professional requirements of each concentration. After a thorough process of feedback and revision, students are required to present their final ePortfolios in a public forum to showcase their work and demonstrate achievement of program competencies.

**EDU 6227. The New Supervisor. (2 Hours)**

Explores leadership, group dynamics, change management, and staff motivation within the field of higher education. Assuming a supervisory role over an established staff creates challenges and opportunities. Students draw from their professional contexts and engage in the process of developing a plan of action for assuming leadership in a new environment.

**EDU 6228. Supervising Through Change. (2 Hours)**

Explores topics such as the role of the supervisor during change, change management theories, communication strategies, leadership, and management techniques in the field of higher education. Leading a team through a change in organizational structure, philosophy, or shift in duties creates unique challenges for supervisors. Offers students an opportunity to navigate the challenge of motivating their staff through an identified change by creating an action plan.

**EDU 6229. Challenges in Supervision. (2 Hours)**

Explores topics around motivating difficult employees, communication techniques, management techniques, action plans, and power dynamics in the field of higher education. Offers students an opportunity to navigate the challenge of working with an underperforming employee.

**EDU 6231. Crisis Management. (2 Hours)**

Offers students an opportunity to identify a potential crisis relevant to their workplace or engage in a simulated crisis experience. Crisis can occur in any job function in higher education administration. Students develop and implement a tabletop exercise to stress-test their crisis management plan.

**EDU 6234. Program Evaluation, Assessment, and Accreditation in Higher Education. (4 Hours)**

Examines the purpose and goals of program evaluation. Offers students an opportunity to explore the different methodologies of program evaluation and the application of results for continuous improvement at their workplace. Reviews various assessment tools, such as NSSE surveys and campus climate surveys. Also explores the role and purpose of accreditation associations and the impact on colleges and universities.

**EDU 6300. Introduction to Language and Linguistics. (4 Hours)**

Explores the foundations of language and linguistics. Discusses theories of the origins of language and compares reading and writing systems of English and other languages. Offers students an opportunity to learn phonology (how sounds are produced), how English works in patterns (linguistics and phonetics), how meaning is conveyed (semantics), and how languages are used (pragmatics). Seeks to provide a foundation for courses related to teaching English as a second language.

**EDU 6310. Literacy Development and the Academic Domains. (4 Hours)**

Offers students an opportunity to learn how to adapt their instruction to the language needs of the students in their classes. Reading, writing, speaking, and listening are the keys to academic success for students for whom English is not the first language. It is critical to understand the research about early literacy development, vocabulary development, process writing, peer editing, comprehension and metacognition, content reading, and literacy assessment. Students read the research, discuss the theory behind the research findings, and have an opportunity to learn how to apply those findings to the unique content and skill challenges they will face as classroom teachers.

**EDU 6319. How People Learn. (4 Hours)**

Introduces the research and science of learning, integrating theory with case studies about learning principles and high-impact practices. Learning takes place in all stages of life: teenagers who go directly from high school to college, adults who "stop out" and return to school after years of work or family commitments, and even retirees who pursue learning made possible by expanded leisure time. Some education takes place formally within higher education; other opportunities are informal, sponsored by organizations such as museums and libraries or available for free online. Focuses on learning in online and mobile environments.

**Prerequisite(s):** EDU 6050 (may be taken concurrently) with a minimum grade of C- or EDU 6204 with a minimum grade of C-

**EDU 6323. Digital Learning Tools and Technologies for LXD. (4 Hours)**

Investigates the role, both current and emerging, that digital tools and technology play in transforming the learning experience. Introduces methodology to align digital tools and technology with outcomes, assessments, and instructional strategies. Emphasizes selecting tools and technologies in accordance with learning science research on instructional and learning strategies, multimedia learning, and universal design principles. Evaluates outcomes—learning, engagement, and motivation—of learning experience designs (LXD) using data. Offers students an opportunity to experiment with a suite of digital tools and technologies and to develop an online, media-rich learning environment.

**Prerequisite(s):** EDU 6051 with a minimum grade of C-

**EDU 6328. Policy and Leadership. (4 Hours)**

Designed to engage students in systems thinking, specifically about how education policies at the federal and state levels impact teaching and learning in elementary and secondary schools. Studies the fundamentals of how policy is created and implemented and analyzes the ways in which competing visions of the purpose of public education frame policy debates and outcomes. Focuses on a variety of contemporary policy initiatives. Offers students an opportunity to evaluate the effectiveness of specific policies that relate closely to their professional roles and to seek to identify and practice the skills educators need in order to assume leadership roles in directly and indirectly influencing policy.

**Prerequisite(s):** EDU 6050 with a minimum grade of C-

**EDU 6329. Connecting Theory and Practice. (4 Hours)**

Involves participants in ePortfolio-based reflection regarding professional goals, progress toward program- and concentration-level competencies, and opportunities for connecting theory and practice. Investigates the “integrative knowledge” approach to evidence-based learning, reflection, and professional identity development. With input and feedback from peers, faculty, and the student’s professional environment, participants then have an opportunity to develop a plan for experiential learning. The plan describes a three-to-five-month workplace-based, scholar-practitioner experience that is responsive to the needs of the employer, yet also steeped in the contemporary issues, science, and theory of learning design.

**Prerequisite(s):** EDU 6050 with a minimum grade of C- or EDU 6204 with a minimum grade of C-

**EDU 6330. Digital Media Literacy. (4 Hours)**

Addresses how K-12 educators learn and use digital media literacy to prepare students for the world of tomorrow. Introduces students to innovative teaching and assessment practices as well as theoretical and philosophical orientations around participatory culture and literacies. Examines the interrelationships between cultural competencies, traditional literacy, research skills, technological skills, and critical thinking skills. Explores the role of ethics, authentic assessments of student learning, and differentiation of instruction in K-12 contexts. Requires graduate students to demonstrate advanced levels of study, application, and research.

**Prerequisite(s):** EDU 6050 (may be taken concurrently) with a minimum grade of C-

**EDU 6331. E-Learning Design as a Collaborative Profession. (4 Hours)**

Explores the process of working with others to identify strategic directions about an institution’s vision for the future, investment of resources, and distinctiveness; to benefit from multiple perspectives and sets of expertise, such as educators, technologists, and institutional researchers; and to respond constructively to conflicting visions and interests. Online and mobile learning is a complex venture. At the program level, key players collaborate on the development of curricula that often need to be vetted at many levels of the institution. E-learning designers often play a critical role in the project management of program and course development. Offers students an opportunity to consider their individual strengths and growth areas as collaborators.

**Prerequisite(s):** EDU 6050 with a minimum grade of C-

**EDU 6332. Open Learning. (4 Hours)**

Investigates the history, philosophy, and theoretical perspectives of open learning. While face-to-face classrooms have physical limits on how many people can attend, millions of people can access the same materials at the same time using online and mobile environments. Early innovators on the Web proclaimed that “information wants to be free.” This perspective is the heart and soul of open learning, whose mission often includes global and affordable access to education. Analyzes whether an open approach is appropriate for the learning scenario, the strategy for sustainability, if the learning experience is equally viable across cultural and economic demographics. Takes a case-study approach that investigates and critically analyzes open learning exemplars. Expects students to design and develop an open learning experience.

**Prerequisite(s):** EDU 6050 with a minimum grade of C- or EDU 6204 with a minimum grade of C-

**EDU 6334. Foundations of Learning Experience Design. (4 Hours)**

Designed to orient students to the learning design profession and introduces the foundational elements of learning experience design. Emphasizes core theories, design frameworks, and delivery methodologies. Offers students an opportunity to practice introductory design-related skills.

**Prerequisite(s):** EDU 6050 (may be taken concurrently) with a minimum grade of C- ; EDU 6319 (may be taken concurrently) with a minimum grade of C-

**EDU 6335. Advanced Practices in Learning Experience Design. (4 Hours)**

Guides students through an entire learning design planning process. Includes an initial analysis of needs; the design of aligned objectives, learning strategies, and assessments; and resource development, delivery methods, implementation, and evaluation planning. Emphasizes creation of authentic learning-based solutions to identify problems of practice using design models that align with scope, content, learning context, and learner.

**Prerequisite(s):** EDU 6334 with a minimum grade of C-

**EDU 6336. Data Literacy for Data-Driven Decision Making. (4 Hours)**

Explores the role that data plays in decision making. Emphasizes the use of data to determine needs, unpack performance data, and interpret course or program performance measures. Highlights data exploration and analysis methods that support data visualization storytelling. Examines ethical and cultural implications around data use.

**EDU 6338. Learning Experience Design Studio. (4 Hours)**

Offers students a loosely-structured design space for the independent creation of an authentic learning experience or product (e.g., course, workshop, webinar, app, website), guided by professional learning designers. Emphasizes individual design decision-making and creative risk-taking opportunities throughout the learning design process, while also providing collaborative opportunities for critiquing, inspiring, and uplifting peers through the successes and challenges indicative of the learning design field.

**Prerequisite(s):** EDU 6335 with a minimum grade of C-

**EDU 6410. Instructional Leadership. (4 Hours)**

Seeks to develop classroom leaders, department leaders, curriculum coordinators, and instructional coaches who focus their efforts on implementing practices that positively impact student learning. Explores how to design learning experiences that incorporate different combinations of innovative pedagogical approaches. Offers students an opportunity to develop the competencies instructional leaders need to shape a vision of academic success for all students; cultivate leadership capacity in others; and manage people, data, and processes to develop the skills, knowledge, networks, and experiences to design systems for greater equity.

**EDU 6415. Law, Policy, and the Ecosystem of Education. (4 Hours)**

Situates current local, state, and federal educational laws and policies in a larger social, political, economic, and historical context. Recognizes and addresses multiple structures across the education ecosystem that perpetuate inequalities in access to high-quality learning and instruction for all. Debates and recommends best practices to empower and protect teachers, students, and families from current laws, policies, and regulations.

**EDU 6425. Special Education: Role of Special Educators in an Inclusive School. (4 Hours)**

Designed to enable teachers to plan for the broad and varied range of student learning and behavior and build a foundation for inclusive schools. Offers students an opportunity to understand the policies and regulations in special education; the role of the special educator in writing and implementing individual education plans (IEPs); the responsibility of special educators to create partnerships with families; and the role of the special educator in working within the school on curriculum across disciplines, service delivery for students with IEPs, and co-teaching models. Explores high- and low-tech assistive technology options and its integration into practice and the facilitation of principles of universal design. Using a case-study approach offers students an opportunity to analyze and problem-solve scenarios derived from field experience.

**EDU 6426. Developmental Language, Literacy, and Writing: Assessment and Instruction. (4 Hours)**

Introduces fundamental theoretical instructional principles of developing oral and written language, reading, writing, and language arts skills. Offers students an opportunity to learn about materials, instructional strategies, classroom-based assessment for literacy development and instruction, and empowering both elementary and secondary readers. Links a focus on early literacy acquisition with clinical assessment and questions regarding English-language learners and students with mild-to-moderate learning disabilities and variations. Studies a multisensory, tiered evidenced-based reading program with a strong phonological foundation, including how specific dyslexia scales are used for early identification and monitoring.

**EDU 6429. Variations in Child and Adolescent Development. (4 Hours)**

Reviews the biological, neuropsychological, psychosocial, cognitive, behavioral, and ecological theories of development. Examines variations and progress in the developmental domains and the intersection among these domains in development and learning in terms of disability and language differences within these theoretical perspectives. The impact of culture on development is infused throughout. Introduces assessments and interventions in development and learning.

**EDU 6438. Teachers as Curriculum Leaders. (4 Hours)**

Explores how to translate curriculum development theory and vision into advocacy and action. Offers students an opportunity to develop a perspective and skills that allow them to be effective teacher-leaders in modifying curriculum across content areas, including math, science, history, and English-language arts. Seeks to prepare students to lead initiatives and projects, including those at the classroom, school, and district level. Examines state curriculum frameworks and other standards alignment and evaluation.

**EDU 6513. Sheltered English Immersion in the General Classroom. (4 Hours)**

Seeks to prepare Massachusetts teachers across pre-K–12 classroom settings to effectively teach and assess English-language learners, ensuring students' abilities to access grade-level curriculum, achieve academic success, and build upon and contribute their cultural strengths and skills to their learning settings. Uses evidence-based principles to offer participants an opportunity to plan Sheltered English Immersion lessons in a Sheltered Instructional Observation Protocol template using the WIDA English Language Development Standards. This course meets DESE requirements for the SEI endorsement as a stand-alone course. Requires fieldwork in an appropriate pre-K–12 setting.

**EDU 6517. Foundations of Teaching English as a Second Language: Research and Practice. (4 Hours)**

Reviews the basics of language acquisition theory and explores how to translate those theories into practical strategies for teaching content in culturally sensitive ways using the Sheltered Instruction Observation Protocol (SIOP), World-Class Instructional Design and Assessment (WIDA) standards, and the Common Core. Addresses basic strategies for incorporating academic vocabulary into content instruction and assessment of language proficiency. Every educator shares the responsibility for ensuring that students who are in the process of learning English have every opportunity to increase their understanding of the content. This requires understanding the cultural context of each student's background and the level of their progress in English-language acquisition. Joins theory to practice by introducing students to current instructional research and practice and includes fieldwork.

**EDU 6528. Adaptive Learning/Behavior Management Strategies: Consultation and Collaboration. (4 Hours)**

Seeks to extend participants' competence in theory, research, and practice pertaining to creating a sense of classroom community, family engagement, and school culture. Examines behavior management approaches and offers participants an opportunity to develop practical interventions and skills for preventing, intervening, and remediating behavior problems. Participants also have an opportunity to apply inclusive principles to the classroom, examine student issues and learning needs, and analyze delivery models to consider how to impact participants' teaching, classroom, and school.

**EDU 6558. Issues in Education. (1-4 Hours)**

Offers students an opportunity to explore in-depth a current educational issue, long-standing unresolved educational problem, and/or ways of considering innovation and change in education. The topic alternates each time the course is offered, and students are allowed to enroll each time the focus of the course changes. May be repeated up to 15 times for up to 16 total credits.

**EDU 6569. Differentiated Instruction and Assessment in Mathematics. (4 Hours)**

Focuses on the development of individualized intervention programs for children and youth in need of special education. Offers students an opportunity to translate results of norm-referenced diagnostic assessments and curriculum-based or criterion-referenced assessments into goals for intervention and effective instructional strategies. Explores the use of data to differentiate mathematics and other instruction. Offers students an opportunity to learn the limitations of assessments and to develop informal classroom-based assessments that reflect student learning and drive instruction.

**EDU 6866. Teaching Practicum and Seminar. (1-8 Hours)**

Includes at least 300 hours of supervised student teaching in a public school system and reflection seminar. Provides a field-based assessment of teaching performance for students in one of the MAT programs. Requires prior successful completion of all Commonwealth of Massachusetts licensure prerequisites. May be repeated for up to 8 total credits.

**Prerequisite(s):** EDU 6104 with a minimum grade of C-

**EDU 6874. Practicum, Portfolio, and Panel Review. (4 Hours)**

Contains both a portfolio requirement and a panel review in addition to a supervised practicum. The portfolio that is submitted includes work products demonstrating the competencies specified in the Professional Standards for Teachers. The review panel is composed of School of Education faculty members, a partner-school special educator/administrator, and community members. Requires students to present a video and/or portfolio in which they demonstrate competencies.

**EDU 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EDU 6980. Interdisciplinary Capstone. (2 Hours)**

Offers students an opportunity to act as reflective change agents as they apply the knowledge and skills gained from their individualized programs of study to the creation of a final project, an action research proposal. The proposal, presented to faculty and peers, identifies a workplace problem or need and includes an implementation plan to address it. Students also have an opportunity to reflect on their learning journey and to refine their original Professional Learning Plan (PLP) with a five-year focus.

**Prerequisite(s):** EDU 6183 with a minimum grade of C-

**EDU 6995. Project. (1 Hour)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field.

**Prerequisite(s):** EDU 6107 with a minimum grade of B or EDU 6425 with a minimum grade of B or EDU 6310 with a minimum grade of B

**EDU 7204. Global and Historical Perspectives on Higher Education. (3 Hours)**

Provides a historical foundation for understanding how current trends in higher education are informed by ideas and practices from the past. Compares seminal theories of teaching and learning, benchmarks in the evolution of higher education, and changing notions about the purposes of higher education cross-culturally over time. Offers students an opportunity to gain a more sophisticated perspective on today's changing landscape in higher education across the world.

**Prerequisite(s):** EDU 7207 with a minimum grade of C- or EDU 7209 with a minimum grade of C-

**EDU 7207. Foundations of Doctoral Studies. (3 Hours)**

Examines professional doctoral studies, the construct of scholar-practitioner, and the role of action research in creating change for social justice. Offers students an opportunity to define problems of practice and explore the basic components of action research.

**EDU 7213. Education Entrepreneurship. (3 Hours)**

Examines how entrepreneurial activity can make a significant impact on the lives of others and considers how political, social, and community conditions can either support or hinder such activity. Uses several contemporary case studies to examine how individuals and groups have pursued entrepreneurial activity. Through scenario planning students analyze the critical elements that lead to successful entrepreneurial activity. At the end of the course, offers students an opportunity to design their own entrepreneurial endeavor grounded in the impact they would like to make for others and their communities. Educators at all levels need to be innovators, capable of creating, facilitating, and supporting entrepreneurial activity that serves others and their communities.

**Prerequisite(s):** EDU 7209 with a minimum grade of C- or EDU 7207 with a minimum grade of C-

**EDU 7217. Educational Systems: The Dynamics of Policy, Power, and Practice. (3 Hours)**

Introduces the policy process, education governance, and education policy issues. Critically analyzes professional practice and problems of practice within the broader context of local, state, and federal education policy systems. The course is divided into four units: the foundations of education policy; education governance and policy subsystems; the policy process; and analyzing policy to develop more just and equitable educational outcomes.

**Prerequisite(s):** EDU 7207 with a minimum grade of C-

**EDU 7218. Leadership for Social Justice. (3 Hours)**

Examines how knowledge is produced in the context of historical and contemporary understandings of power. Focuses on change agency through ongoing self-examination, context analysis, and development of an action plan.

**Prerequisite(s):** EDU 7207 with a minimum grade of C- ; EDU 7225 (may be taken concurrently) with a minimum grade of C-

**EDU 7219. Foundations of Collaboration, Leadership, and Change. (3 Hours)**

Focuses on the collaborative nature of leadership and the skills necessary to enact change. Considers the importance of teamwork in the collaboration process along with an understanding of what makes teams effective from both relational and task perspectives. Students examine their own role as a change agent and explore opportunities for social change from diverse and global perspectives. In combination with other foundation and research courses, offers students an opportunity to develop and execute action research plans.

**Prerequisite(s):** EDU 7218 with a minimum grade of C- ; EDU 7226 (may be taken concurrently) with a minimum grade of C-

**EDU 7225. Fundamentals of Research. (3 Hours)**

Examines the theory and philosophy behind qualitative, quantitative, and mixed-methods approaches to action research. Additional course topics include understanding research paradigms, translating theory to practice, and exploring the roles of stakeholders. Offers learners an opportunity to gain skills in collecting data, creating research questions, and exploring ethical considerations of conducting research.

**Prerequisite(s):** EDU 7207 (may be taken concurrently) with a minimum grade of C-

**EDU 7226. Research Design. (3 Hours)**

Introduces learners to qualitative and quantitative research methodology. Emphasizes qualitative data collection, making meaning of data, and creating an action plan for research. Offers students an opportunity to practice sharing data in a meaningful way to promote reflection on change.

**Prerequisite(s):** EDU 7207 with a minimum grade of C- ; EDU 7218 (may be taken concurrently) with a minimum grade of C- ; EDU 7225 with a minimum grade of C-

**EDU 7227. The Power of Experiential Learning. (3 Hours)**

Examines the theory and employment of personal, group, and organization-based experiential learning to effect change and innovation. By employing experiential learning we seek to transform our thinking, understanding, and actions of how we can design, support, and use experiential learning in our contexts to engender individual, educational, and organizational development, improvement, and transformation.

**Prerequisite(s):** EDU 7207 with a minimum grade of C- or EDU 7209 with a minimum grade of C-

**EDU 7228. Bringing Experiential Learning, Assessment, and Reflection to Life. (3 Hours)**

Offers students an opportunity to design, develop, and pursue organizational experiential learning activities, reflection, and assessment to explore understanding the impact and influence of experiential learning. Students design and implement the oversight of an experiential learning initiative and assess outcomes.

**Prerequisite(s):** EDU 7207 with a minimum grade of C- or EDU 7209 with a minimum grade of C-

**EDU 7229. The Experiential Learning Leader. (3 Hours)**

Focuses on the role of the leader in the design and use of experiential learning to effect improvement and change. The experiential learning leader engages their colleagues and community in experiential learning design, actions, reflection, and assessment, empowering others and their organization in that process. Explores and develops employing experiential learning tools—the skills, mindset, and competencies to lead through experiential learning.

**Prerequisite(s):** EDU 7207 with a minimum grade of C- or EDU 7209 with a minimum grade of C-

**EDU 7234. Thinking and Acting Entrepreneurially. (3 Hours)**

Considers theory, research, and case studies to critically analyze entrepreneurial thinking, behaviors, and pursuits. Explores insights as to how entrepreneurial thinking and activity can lead to the transformation of agency and organizational capacity. Offers students an opportunity to understand how the entrepreneurial mindset can lead to the transformation of one's actions and an organization's structures, practices, and use of resources to effect desired outcomes.

**Prerequisite(s):** EDU 7209 with a minimum grade of C- or EDU 7207 with a minimum grade of C-

**EDU 7243. Doctoral Seminar in Curriculum Leadership. (3 Hours)**

Offers a special topics course that examines critical and timely issues challenging curriculum leaders. Through individual consultations with the instructor and critical feedback from their peers, offers students an opportunity to explore these topics and discuss how they relate to applied research in the field of curriculum leadership.

**EDU 7250. Organizational Systems and Institutional Governance. (3 Hours)**

Examines the issues related to shared governance. Focuses on managing and leading in an environment of shared governance. Institutions of higher education are unlike any other kind of institutions in either the public or private sector. The difference is largely due to the concept and use of shared governance. Other topics include variations of shared governance and organizational structures.

**EDU 7251. Student Engagement in Higher Education. (3 Hours)**

Examines influential student development theories and theorists. The higher education sector in the United States and around the world is being transformed by competitive forces that require institutions to be market-driven. Analyzes the implications of work on enrollment management and students in a market-driven environment.

**EDU 7253. The Legal Environment of Higher Education. (3 Hours)**

Examines the major laws that impact the decision making of higher education leaders and emphasizes strategies for navigating the legal environment and managing potential legal threats. Institutions of higher education operate in a complex legal environment that includes laws related to financial aid, admissions, licensure, and privacy.

**EDU 7256. Financial Decision Making in Higher Education. (3 Hours)**

Explores financial aspects of postsecondary educational institutions with particular emphasis on the use of financial information for decision making. Specific topics include financial analysis, budget creation, and budget oversight. Examines both cost-center and RCM models. Emphasizes using financial data for decisions related to resource allocation, forecasting, and other planning and control activities in higher education.

**EDU 7258. Strategic Management in Higher Education. (3 Hours)**

Examines strategic management from multiple conceptual and intellectual traditions. Focuses on the latest research and situates strategic management within the context of higher education.

**EDU 7259. Doctoral Seminar in Higher Education Administration. (3 Hours)**

Offers a special topics course that examines critical and timely issues challenging postsecondary leaders. Through individual consultations with the instructor and critical feedback from their peers, this course offers students an opportunity to explore these topics and discuss how they relate to applied research in the field of higher education administration.

**EDU 7260. Comparative International/Global Higher Education. (3 Hours)**

Examines the many educational systems that exist around the world, along with worldwide emerging trends in education. An understanding of these global models can better inform policy decisions, institutional strategies, and pedagogy at the micro- and macrolevels. Emphasizes topics of governance, credentialing, assessment, portability, funding, curriculum, and instruction. Examines current and emerging trends resulting from changing demographic and economic shifts, as well as varied reform initiatives.

**EDU 7261. International Student Markets. (3 Hours)**

Examines the characteristics and drivers that influence the needs and interests of various student markets, as well as current strategies being employed domestically and internationally to recruit and retain international students. International students have become a major factor in education markets that include specialized preparatory schools to major research universities. Many schools have relied on international students, who generally pay full tuition, to meet tuition revenue targets. As the world economy continues to globalize, and the importance of knowledge-driven industries expands, the importance of understanding and competing in global education markets continues to increase.

**EDU 7266. Contemporary Issues in Community Colleges. (3 Hours)**

Examines contemporary issues facing community college administration, including promoting equity, open access, diversity and affirmative action, transfer policies, workforce development, and developmental education.

**EDU 7272. Organizational Culture and Change. (3 Hours)**

Examines organizational culture models and change processes through the lenses of seminal theory and current research. Focuses on how organizational culture develops and evolves and discusses the relationship of organizational culture to leadership and organizational effectiveness. Students engage in an experiential field project that simultaneously seeks to build understanding of culture in practice and to enhance doctoral-level research skills. The capability to build effective local organizational cultures that function within larger cultural systems and to create lasting cultural change are key for effective leadership. With a deep understanding of organizational culture, students become empowered to organize systems, symbols, and people in ways that influence planning, policies, and resource allocations in their organizations.

**Prerequisite(s):** EDU 7209 with a minimum grade of C- or EDU 7207 with a minimum grade of C-

**EDU 7274. Doctoral Seminar in Organizational Leadership and Communication. (3 Hours)**

Examines critical and timely issues challenging education leaders. Uses individual consultations with the instructor and critical feedback from their peers to offer students an opportunity to focus their thesis arguments and articulate how their projects contribute to applied research in the field of organizational leadership and communication. May be repeated up to four times.

**EDU 7275. Contemporary Leadership Perspectives. (3 Hours)**

Reviews contemporary leadership theory and models emphasizing recent conceptualizations, such as relational, distributed, complexity, followership, and global leadership. Using these models as a diagnostic lens, offers students an opportunity to explore and develop real-world answers to the leadership challenges facing their organizations. Emphasizes personal leadership development, which allows students to expand, apply, reflect on, and refine their personal leadership knowledge, skills, and abilities to further how they steward their organizations. Understanding the theory and research underpinning current leadership practice is invaluable knowledge for any organizational leader.

**Prerequisite(s):** EDU 7209 with a minimum grade of C- or EDU 7207 with a minimum grade of C-

**EDU 7276. Communication: Teams, Organizations, and Global Networks. (3 Hours)**

Examines the ways we interact, make meaning, and work together—in our teams, within our organizations, and throughout global networks. Teams are the foundational, organizational archetype for bringing groups of people together to get things done. An essential experiential component of the course is the study of teamwork, analyzing the development and functioning of the team along with assessing individual roles and responsibilities. Considers organizations from perspectives such as messaging and meaning making, identity and relationships, and social media/technology. Finally, examines global networks of individuals and/or communities through levels of interconnectivity worldwide and through varying forms of social interaction.

**Prerequisite(s):** EDU 7209 with a minimum grade of C- or EDU 7207 with a minimum grade of C-

**EDU 7280. Fundamentals of Research. (3 Hours)**

Offers students an overview of all components of a doctoral thesis. Designed to support students' efforts to hone in on their specific area of research and to write a problem of practice, research questions, and literature review. Offers students feedback on their work from faculty and peers in the course in order to complete a rough draft of the first two chapters of their potential thesis proposal.

**Prerequisite(s):** EDU 7202 with a minimum grade of C- ; EDU 7209 with a minimum grade of C- ; EDU 7210 with a minimum grade of C- ; EDU 7214 with a minimum grade of C-

**EDU 7281. Research Design. (3 Hours)**

Focuses on turning a research question into a potential thesis. Emphasizes effective alignment of problem, purpose, question, theory, and method. Offers students an opportunity to examine various qualitative and quantitative research designs and to explore the role of theory in each design. Encourages students to seek to gain a clear understanding of methodology and the different approaches and theories scholars have used to investigate their area of interest. Seeks to guide students through the process of creating a detailed outline that articulates all design components of their theses.

**Prerequisite(s):** EDU 7280 with a minimum grade of C-

**EDU 7283. Qualitative Research. (3 Hours)**

Introduces students to a variety of methodological approaches in order for them to conceptualize their doctoral thesis research from the perspective of multiple qualitative perspectives. Students conduct a field project with the goal of gaining skills in collecting and analyzing data. Students should conclude the research series with a conceptual foundation for their doctoral thesis and familiarity with the proposal development process.

**Prerequisite(s):** EDU 7205 with a minimum grade of C- or EDU 7208 with a minimum grade of C- or EDU 7281 with a minimum grade of C-

**EDU 7294. Advanced Research Design 1. (3 Hours)**

Offers students an opportunity to engage in cycle 1 of their action research project. Emphasizes techniques to support data collection and analysis, as well as communication of findings. Projects must be IRB-approved before students can enroll in this course.

**Prerequisite(s):** EDU 7207 with a minimum grade of C- ; EDU 7218 with a minimum grade of C- ; EDU 7219 with a minimum grade of C- ; EDU 7225 with a minimum grade of C- ; EDU 7226 with a minimum grade of C-

**EDU 7295. Dissertation in Practice Seminar. (3 Hours)**

Introduces learners to the tools, skills, and practical aspects of constructing a dissertation proposal plan for completing action research for the dissertation in practice. Learners practice writing a literature review and construct a plan for completing their dissertation research.

**Prerequisite(s):** EDU 7294 with a minimum grade of C-

**EDU 7310. Advanced Research Design 2. (3 Hours)**

Offers students an opportunity to extensively explore their problem of practice through expanded data collection and review. Students use analytical research tools to reveal insights into their problems of practice and inform future cycles of research. Project must be IRB-approved.

**Prerequisite(s):** EDU 7294 with a minimum grade of C-

**EDU 7311. Designing Educational Systems for Justice and Equity. (3 Hours)**

Provides an overview of transformative educational models that center justice and equity across a diverse range of learning contexts. Education leaders across contexts must be innovators, capable of facilitating the generation and advancement of new ideas and strategic initiatives to promote greater learning and greater equity. Offers students an opportunity to engage with current and emerging theories and practices related to designing and transforming educational systems that are grounded in equity and justice.

**Prerequisite(s):** EDU 7207 with a minimum grade of C-

**EDU 7312. Landscape of Educational Leadership. (3 Hours)**

Offers an overview of the history and context of educational leadership, including leadership theory and foundational models of leadership. Examines local, state, and global trends in education. Provides direct application to a variety of school settings. Emphasizes transformative and justice-oriented leadership throughout the course.

**Prerequisite(s):** EDU 7207 with a minimum grade of C-

**EDU 7313. Leading and Managing Change. (3 Hours)**

Examines current and emerging challenges across educational contexts. Focuses on building capacity for transformative leaders. Emphasizes three main areas related to leading change: developing a greater understanding of models for leading local and educational district change initiatives; developing leadership capability, including mentoring and coaching; and developing shared and collaborative leadership models. Explores potential supports and constraints, moving beyond the traditional paradigms, structures, policies, and practices. Offers direct application to school settings as students apply concepts to their practice of leading change.

**Prerequisite(s):** EDU 7207 with a minimum grade of C-

**EDU 7315. Landscape of Teaching and Learning. (3 Hours)**

Explores the history and context of teaching and learning by examining curriculum theory and trends in curriculum development. Examines local, state, and global trends in education by focusing on the social, political, and other contextual factors that influence the ever-changing nature of curriculum work. Emphasizes curriculum that fosters antiracist teaching and culturally responsive pedagogy. Provides direct application to a variety of school settings.

**Prerequisite(s):** EDU 7207 with a minimum grade of C-

**EDU 7316. Designing Transformative Curriculum and Professional Development. (3 Hours)**

Examines transformative models for teaching and learning. Offers students an opportunity to develop competencies in designing and delivering curriculum in a variety of P-20 learning settings. Focuses on four main areas related to leading curriculum change: developing a greater understanding of transformative models for curriculum; designing curriculum; delivering professional development, including mentoring peers; and assessing the effectiveness of the design and delivery process. Embedded within the course are opportunities for experiential learning, so that students may apply concepts learned to practice by integrating and delivering innovative curriculum.

**Prerequisite(s):** EDU 7207 with a minimum grade of C-

**EDU 7317. Collaboration and Networks in Teaching and Learning. (3 Hours)**

Offers students an opportunity to practice leadership innovation through collaboration, planning, and implementation. Designed to merge conceptual knowledge with active and applied participation in real-world contexts. Explores contemporary initiatives intended to address challenges in K-12 educational contexts. Students collaborate with practicing educational leaders to investigate, plan, and implement solutions to complex issues being confronted by partner schools.

**Prerequisite(s):** EDU 7207 with a minimum grade of C-

**EDU 7461. Data-Driven Decision Making for Workplace Learning. (3 Hours)**

Focuses on how learning organizations make strategic decisions informed by data. Discusses the use and operationalization of emerging data analytics trends in relation to workplace domains in K-12, higher education, and industry to obtain fluency and understanding of the fundamental strategic skills to improve collaboration and decision-making in an organization or institution. Offers students an opportunity to learn how to discern decisions that lead to maximized human capital, how to create environments that are conducive to learning, how to increase productivity, and how to achieve organizational success that acknowledges the equity and diversity of the organization and leads to justice-oriented work.

**Prerequisite(s):** PST 7700 with a minimum grade of C- or EDU 8100 with a minimum grade of C-

**EDU 7501. Designing Workplace Learning. (3 Hours)**

Explores foundational theories and methods for learning in the workplace. Discusses fundamental learning tenets that support high-performing workplace learning programs, initiatives, and functions across modalities. Focuses on the promotion and design of successful and multilevel program outcomes that are strategically aligned to the organizational mission and support justice-oriented work.

**Prerequisite(s):** EDU 7207 with a minimum grade of C-

**EDU 7502. The Dynamics of Workplace Learning. (3 Hours)**

Focuses on emerging dynamics of organizations with the conditions to foster new knowledge and, in turn, foster conditions to create new knowledge, leading to a just and equitable workforce. Offers students an opportunity for hands-on experience within and across innovative workplace systems.

**Prerequisite(s):** EDU 7207 with a minimum grade of C-

**EDU 7503. Leading the Learning Strategy. (3 Hours)**

Focuses on the role of leading the creation of an actionable learning strategy in meeting an organization's objectives, leading to justice-oriented work. Topics include alignment with objectives, skills, and capabilities needed to deliver upon an organization's objectives; needs assessments; a governance model for stakeholder partnerships; multimodal learning journeys; and harnessing analytics to shape the learning and development agenda.

**Prerequisite(s):** EDU 7207 with a minimum grade of C-

**EDU 7504. Diversity, Equity, and Inclusion in Workplace Learning. (3 Hours)**

Focuses on developing a deeper understanding of the value of diversity, equity, and inclusion in workplace learning and development. Explores how to create learning experiences that recognize and influence social inequities experienced by marginalized populations and to create learning strategies for greater inclusivity and productivity across the organization.

**Prerequisite(s):** EDU 7207 with a minimum grade of C-

**EDU 7505. Writing a Publishable Article. (3 Hours)**

Provides students an opportunity to write publishable journal articles from pre-existing research. Introduces the complex world of academic publishing, supporting students in adapting course papers, professional papers, or dissertations for publication in a professional or academic journal. Offers writers from K-12 education, higher education, and workplace learning practical experience in getting their work published in peer-reviewed journals. Explains the publication process and shares strategies for achieving success in the academic writing arena. In a supportive environment, students revise a draft (often a classroom paper, conference paper, or dissertation chapter) into a peer-reviewed article and submit it for publication. The goal of this course is to aid students in taking their papers from classroom quality to journal quality and overcoming anxiety about academic publishing.

**Prerequisite(s):** PST 7700 with a minimum grade of C- or EDU 8100 with a minimum grade of C-

**EDU 7510. Data-Driven Decision Making. (3 Hours)**

Focuses on how learning organizations make strategic decisions informed by data. Offers students an opportunity to learn how to discern decisions that lead to maximized human capital, how to create environments that are conducive to learning, how to increase productivity, and how to achieve organizational success that acknowledges the equity and diversity of the organization and leads to justice-oriented work.

**Prerequisite(s):** EDU 7207 with a minimum grade of C-

**EDU 7511. Digital Workplace Learning. (3 Hours)**

Offers students opportunities to investigate current and emerging technologies and their application in the context of formal and informal digital workplace learning. Students examine theories of digital workplace learning while considering diverse stakeholder perspectives that may lead to justice-oriented work. Explores digital workplace learning happening at the individual, social, and organizational levels.

**Prerequisite(s):** EDU 7207 with a minimum grade of C-

**EDU 7976. Directed Study. (1-4 Hours)**

Offers students an opportunity to carry out an individual reading and research project under the supervision of a faculty member. The directed study format allows for the in-depth analysis of a particular topic not covered in-depth or the study of a subject not typically covered in the curriculum. A directed study proposal must be approved by the faculty sponsor, division head, and senior associate dean for academic affairs.

**EDU 8750. Proposal, Action Step, and Evaluation. (6 Hours)**

Offers students an opportunity to make progress toward their dissertation in practice proposal and submit modifications, if necessary, to the IRB. Following IRB authorization, students prepare to conduct the action step, analyze the data, and write up initial field reports. Students work toward evaluating the effectiveness of the action step.

**Prerequisite(s):** EDU 7295 with a minimum grade of C-

**EDU 8751. Proposal, Action Step, and Evaluation Continuation. (0 Hours)**

Offers students an opportunity for continued dissertation work conducted under the supervision of their faculty chair toward the completion of their proposal and action step.

**EDU 8760. Action Research Results and Dissemination. (6 Hours)**

May support the processes associated with writing the results and disseminating the results to relevant stakeholders. Successful completion is determined by the student's defense of the final dissertation in practice that is approved by the student's committee.

**EDU 8761. Action Research Results and Dissemination Continuation. (0 Hours)**

Offers students an opportunity for continued dissertation work conducted under the supervision of their faculty chair toward the completion of a student's defense of the final dissertation in practice that is approved by the student's committee.

**EDU 8762. Dissertation in Practice Research. (0 Hours)**

Offers students an opportunity for continued dissertation work conducted under the supervision of their faculty chair toward the completion of the student's defense of the final dissertation in practice that is approved by the student's committee. May be repeated three times.

**EDU 8791. Doctoral Thesis Continuation. (0 Hours)**

Offers students an opportunity for continued doctoral thesis work conducted under the supervision of departmental faculty.

**EDU 8792. Doctoral Thesis Continuation. (0 Hours)**

Offers students an opportunity for continued doctoral thesis work conducted under the supervision of departmental faculty.

**Prerequisite(s):** EDU 8791 with a minimum grade of S

**EDU 8796. Thesis Proposal. (0 Hours)**

Offers support for the thesis proposal. Students work toward editing the first two chapters of their proposals in order to update or expand the literature review with recent contributions that have been made to the different bodies of research that inform their studies. Students work toward an initial draft of the doctoral thesis proposal, including introductory chapter and literature review.

**Prerequisite(s):** EDU 7282 with a minimum grade of C- or EDU 7283 with a minimum grade of C-

**EDU 8797. Thesis Data Collection. (0 Hours)**

Offers students an opportunity to work toward approval of the thesis proposal by the Institutional Review Board so that they can begin their research projects. Students work toward designing their data collection and analysis and to follow their clear plans for gathering data.

**EDU 8798. Thesis Data Analysis and Presentation. (0 Hours)**

Offers students an opportunity to work toward engaging in the data analysis process and constructing their presentation strategy for their analyses. Students work toward a completed outline of the fourth thesis chapter approved by the student's thesis advisor and second reader.

**EDU 8799. Thesis Findings and Discussion. (12 Hours)**

Supports the processes associated with writing the results and discussion chapters of the thesis. Highlights the scholar-practitioner aspect of the program's mission, requiring that students think carefully about the practical implications of their work and how they plan to communicate or disseminate those implications to an authentic audience and engage relevant stakeholders in a relevant application of their findings. Successful completion is determined by a student's defense of the final thesis work that is approved by their thesis committee.

**Electrical and Computer Engineering (EECE)****EECE 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EECE 2140. Computing Fundamentals for Engineers. (4 Hours)**

Engages students in problem solving from an engineering perspective, offering essential computer hardware and software knowledge and experience. Computational problem solving involves expressing solutions to engineering problems in a way that a computer can efficiently solve. As our world continues to become more automated and interconnected, it becomes increasingly important to be able to leverage computer software and hardware, enabling us to evaluate and solve real-world engineering challenges. Offers students an opportunity to learn engineering solution design, leveraging a high-level programming language appropriate for interfacing hardware-based systems. Stresses best practices in design. Coursework includes programming assignments, quizzes, and a final project, offering students a number of ways to demonstrate their understanding of the concepts.

**EECE 2150. Circuits and Signals: Biomedical Applications. (5 Hours)**

Offers an integrated lecture/lab course that covers circuit theory, signal processing, circuit building, and MATLAB programming. Introduces basic device and signal models and circuit laws used in the study of linear circuits. Analyzes resistive and complex impedance networks. Uses the ideal operational amplifier model, focusing on differential amplifiers and active filter circuits. Introduces basic concepts of linearity and time-invariance for both continuous and discrete-time systems and concepts associated with analog/digital conversion. Demonstrates discrete-time linear filter design on acquired signals in the MATLAB environment. Offers students an opportunity to explore circuits and signals in the lab and to use their knowledge of circuits, analog signals, digital signals, and biological signals to build a working analog/digital EKG system.

**Prerequisite(s):** (GE 1111 with a minimum grade of D- or GE 1502 with a minimum grade of D-); MATH 2341 (may be taken concurrently) with a minimum grade of D-; (PHYS 1155 (may be taken concurrently) with a minimum grade of D- or PHYS 1165 (may be taken concurrently) with a minimum grade of D- or PHYS 1175 with a minimum grade of D-); EECE 2140 (may be taken concurrently) with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**EECE 2160. Embedded Design: Enabling Robotics. (4 Hours)**

Introduces the basics of digital design and programming for embedded systems through an integrated lecture and lab course. Covers digital design, object-oriented programming, using Linux, and controlling physical devices via software. The lab portion of this course offers hands-on experience at developing hardware and software to control a robotic device via an embedded systems platform.

**Prerequisite(s):** EECE 2140 (may be taken concurrently) with a minimum grade of D- or CS 2510 (may be taken concurrently) with a minimum grade of D-

**EECE 2210. Electrical Engineering. (4 Hours)**

Introduces the basic concepts related to circuits and circuit elements; current, voltage, and power; models for resistors, capacitors, and inductors; and circuit analysis using Kirchhoff's laws. Discusses selected topics that illustrate a variety of applications of electrical engineering, such as AC circuits and electric power, the basics of semiconductor devices with applications to transistor amplifier models, transients in circuits with energy storage, mechanical controls and mechatronics, digital signals, logic circuits, and some basic concepts of computer operations, specifically, number coding, arithmetic operations, and memory circuits.

**Prerequisite(s):** MATH 1342 with a minimum grade of D-

**Corequisite(s):** EECE 2211

**EECE 2211. Lab for EECE 2210. (1 Hour)**

Accompanies EECE 2210. Covers fundamental DC and AC electrical concepts as well as analog and digital electronics.

**Corequisite(s):** EECE 2210

**EECE 2310. Introduction to Digital Design and Computer Architecture. (4 Hours)**

Covers the fundamentals of digital design topics including digital data representations and operations as well as combinational and sequential circuits design. Introduces various topics of computer organization, architecture, and microarchitecture applicable to modern computer engineering systems. Discusses principles of computer memory addressing. Applies the concept of hardware and software interface through programming in assembly language.

**Prerequisite(s):** CS 1800 with a minimum grade of D-

**Corequisite(s):** EECE 2311

**EECE 2311. Lab for EECE 2310. (1 Hour)**

Accompanies EECE 2310. Offers students an opportunity to design and implement various digital circuits that are essential for building computer systems. Utilizes a hardware design platform that is built around Field Programmable Gate Array (FPGA) technology. Covers simulation and testing of designs to solve practical engineering problems.

**Corequisite(s):** EECE 2310

**EECE 2322. Fundamentals of Digital Design and Computer Organization. (4 Hours)**

Presents a global perspective on the design of a full processor taking logic gates as the simplest building blocks. Starts with number systems and data representation and the design of simple combinational and sequential circuits. Continues with an introduction to the instruction set architecture of a selected processor architecture (e.g., RISC-V) and concludes with the construction of a simple processor using a single-cycle and a multi-cycle implementation approach. Assignments include designing and simulating digital hardware models using an appropriate hardware description language (e.g., Verilog), as well as some assembly language to expose the interface between hardware and software.

**Prerequisite(s):** EECE 2160 with a minimum grade of D- or EECE 2310 with a minimum grade of D-

**Corequisite(s):** EECE 2323

**EECE 2323. Lab for EECE 2322. (1 Hour)**

Offers students an opportunity to design and implement a simple computer system on field-programmable logic using a hardware description language. Covers simulation and testing of designs.

**Corequisite(s):** EECE 2322

**EECE 2412. Fundamentals of Electronics. (4 Hours)**

Reviews basic circuit analysis techniques. Briefly introduces operation of the principal semiconductor devices: diodes, field-effect transistors, and bipolar junction transistors. Covers diode circuits in detail; the coverage of transistor circuits focuses mainly on large-signal analysis, DC biasing of amplifiers, and switching behavior. Uses PSpice software to simulate circuits and large-signal models and transient simulations to characterize the behavior of transistors in amplifiers and switching circuits. Digital electronics topics include CMOS logic gates, dynamic power dissipation, gate delay, and fan-out. Amplifier circuits are introduced with the evaluation of voltage transfer characteristics and the fundamentals of small-signal analysis.

**Prerequisite(s):** EECE 2150 with a minimum grade of D- or EECE 2210 with a minimum grade of D- or BIOE 3210 with a minimum grade of D-

**Corequisite(s):** EECE 2413

**EECE 2413. Lab for EECE 2412. (1 Hour)**

Covers experiments reinforcing basic electronics topics such as diodes, bipolar junction transistors (BJT) as a switch, BJT amplifiers, and MOSFET circuits for switching and amplification. Practical measurements include use of voltmeters, ammeters, ohm meters, and impedance meters, as well as oscilloscope measurements of frequency, gain, distortion, and upper- and lower-cutoff frequencies of amplifiers.

**Corequisite(s):** EECE 2412

**Attribute(s):** NUpath Writing Intensive

**EECE 2520. Fundamentals of Linear Systems. (4 Hours)**

Develops the basic theory of continuous and discrete systems, emphasizing linear time-invariant systems. Discusses the representation of signals and systems in both the time and frequency domain. Topics include linearity, time invariance, causality, stability, convolution, system interconnection, and sinusoidal response. Develops the Fourier and Laplace transforms for the discussion of frequency-domain applications. Analyzes sampling and quantization of continuous waveforms (A/D and D/A conversion), leading to the discussion of discrete-time FIR and IIR systems, recursive analysis, and realization. The Z-transform and the discrete-time Fourier transform are developed and applied to the analysis of discrete-time signals and systems.

**Prerequisite(s):** (EECE 2150 with a minimum grade of D- or EECE 2210 with a minimum grade of D- or BIOE 3210 with a minimum grade of D-);

MATH 2341 with a minimum grade of D-

**EECE 2530. Fundamentals of Electromagnetics. (4 Hours)**

Introduces electromagnetics and high-frequency applications. Topics include transmission lines: transmission line model with distributed circuit elements, transmission line equations and solutions, one-dimensional traveling and standing waves, and applications; electromagnetic field theory: Lorentz force equations, Maxwell's equations, Poynting theorem, and application to the transmission line's TEM waves. Also studies uniform plane wave propagation along a coordinate axis and along an arbitrary direction; equivalent transmission lines for TEM, TE, and TM waves; reflection and refraction of uniform plane waves by conducting and dielectric surfaces. Discusses applications to wave guides, resonators, optical fibers, and radiation and elementary antennas. Introduces modern techniques (computational methods) and applications (optics, bioelectromagnetics, and electromagnetic effects in high-speed digital circuits).

**Prerequisite(s):** (EECE 2150 with a minimum grade of D- or EECE 2210 with a minimum grade of D- or BIOE 3210 with a minimum grade of D-); MATH 2321 with a minimum grade of D- ; (PHYS 1155 with a minimum grade of D- or PHYS 1165 with a minimum grade of D- or PHYS 1175 with a minimum grade of D- )

**Corequisite(s):** EECE 2531

**EECE 2531. Lab for EECE 2530. (1 Hour)**

Accompanies EECE 2530. Supports class material related to transmission lines, wave-guiding structures, plane wave reflection and refraction, and antenna radiation. Includes experiments with microwave transmission line measurements and the determination of the properties of dielectric materials, network analyzer analysis of microwave properties of circuit elements and transmission line electrical length, analysis of effective dielectric constant and loss from microstripline resonator transmission, optical measurement of refraction and reflection leading to determination of Brewster angle and optical constants for transparent and absorbing materials, and measurement of radiation patterns from dipole antennas.

**Prerequisite(s):** (BIOE 3210 with a minimum grade of D- or EECE 2150 with a minimum grade of D- or EECE 2210 with a minimum grade of D-); MATH 2321 with a minimum grade of D- ; (PHYS 1155 with a minimum grade of D- or PHYS 1165 with a minimum grade of D- or PHYS 1175 with a minimum grade of D- )

**Corequisite(s):** EECE 2530

**EECE 2540. Fundamentals of Networks. (4 Hours)**

Presents an overview of modern communication networks. The concept of a layered network architecture is used as a framework for understanding the principal functions and services required to achieve reliable end-to-end communications. Topics include service interfaces and peer-to-peer protocols, a comparison of the OSI (open system interconnection) reference model to the TCP/IP (Internet) and IEEE LAN (local area network) architectures, network-layer and transport-layer issues, and important emerging technologies such as Bluetooth and ZigBee.

**Prerequisite(s):** EECE 2140 (may be taken concurrently) with a minimum grade of D- or CS 2100 (may be taken concurrently) with a minimum grade of D-

**EECE 2560. Fundamentals of Engineering Algorithms. (4 Hours)**

Covers the design and implementation of algorithms to solve engineering problems using a high-level programming language. Reviews elementary data structures, such as arrays, stacks, queues, and lists, and introduces more advanced structures, such as trees and graphs and the use of recursion. Covers both the algorithms to manipulate these data structures as well as their use in problem solving. Introduces algorithm complexity analysis and its application to developing efficient algorithms. Emphasizes the importance of software engineering principles.

**Prerequisite(s):** EECE 2160 with a minimum grade of D- or CS 1500 with a minimum grade of D-

**EECE 2750. Enabling Engineering. (4 Hours)**

Offers students an opportunity to develop a proposal for a design project that uses engineering technologies to improve the lives of individuals with cognitive or physical disabilities. Offers student project groups an opportunity to work with end users and caregivers at local nursing homes and special education schools to assess a specific need, research potential solutions, and develop a detailed proposal for a project. Project groups are matched with product design mentors who guide groups through the design process. Lectures cover relevant topics, including surveys of specific physical and cognitive disabilities and applicable engineering technologies. The same project may not be used to satisfy both this course and EECE 4790. May be repeated once.

**EECE 2949. Introductory Directed Research in Electrical and Computer Engineering. (4 Hours)**

Offers first- and second-year students an opportunity to pursue project and other independent inquiry opportunities under faculty supervision. The course is initiated with a student-developed proposal, including expected learning outcomes and research products, which is approved by a faculty member in the department. Requires permission of instructor.

**EECE 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EECE 2992. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors. May be repeated up to nine times.

**EECE 3324. Computer Architecture and Organization. (4 Hours)**

Presents a range of topics that include assembly language programming, number systems, data representations, ALU design, arithmetic, the instruction set architecture, and the hardware/software interface. Offers students an opportunity to program using assembly language and to simulate execution. Covers the architecture of modern processors, including datapath/control design, caching, memory management, pipelining, and superscalar. Discusses metrics and benchmarking techniques used for evaluating performance.

**Prerequisite(s):** EECE 2322 with a minimum grade of D- ; EECE 2323 with a minimum grade of D-

**EECE 3392. Electronic Materials. (4 Hours)**

Provides a basic treatment of electronic materials from atomic, molecular, and application viewpoints. Topics include atomic structure and bonding in materials, structure of materials, and crystal defects. These topics lay a foundation for the introduction of thermal and electronic conduction, which is the underlying physics of electronic devices. Finally, the electronic properties of semiconductors, dielectric, magnetic, superconducting, and optical materials are examined. The latter half deals with an introduction to the state of the art in electronic materials, including semiconductor nanoelectronics, magnetic semiconductors and spintronics, molecular electronics, carbon nanotubes, conducting polymers, diamondlike carbon, and other topics representing recent technological breakthroughs in the area of electronic materials.

**EECE 3400. Introduction to Communication Systems. (4 Hours)**

Covers the basic principles and building blocks of modern digital communication systems. These systems include the current and future generations of wireless services (e.g., 6G) and are predicted to become a multi-billion-dollar market in the next decade. Industrial giants at the forefront of related research and development include market-leading hardware and software companies, offering an increasing scope of employment opportunities. Includes the background of developments such as radio signal propagation, frequency spectrum regulation and resource division among multiple users, digital representation and compression of information, signal modulation and demodulation, information detection in the presence of noise and channel impairments, coding for improved reliability, and system performance analysis and simulation.

**Prerequisite(s):** EECE 2150 with a minimum grade of D- ; MATH 2341 with a minimum grade of D-

**EECE 3410. Electronic Design. (4 Hours)**

Covers advanced analog and mixed-signal circuit analysis topics. Introduces analog integrated circuits (ICs) concepts with bipolar and field effect transistor devices. Covered IC building blocks include current sources and active loads, differential stages, cascode configurations, gain stages, and output stages. The uses of the building blocks are demonstrated for the design of popular ICs, such as operational amplifiers and voltage comparators. The high-frequency circuit models of transistors are described and used to evaluate the frequency responses of amplifiers. Introduces analog-to-digital and digital-to-analog conversion concepts and the concepts of feedback and instability with applications to the design of amplifiers and oscillators. The course makes extensive use of the SPICE simulation tool for assignments and projects.

**Prerequisite(s):** EECE 2412 with a minimum grade of D-

**EECE 3468. Analysis of Random Phenomena in Electrical and Computer Engineering. (4 Hours)**

Studies analytical concepts and methods for solving engineering problems involving randomness. Uses applications such as data analytics, artificial intelligence, signal processing, computer networks, electronic devices, and sensing systems as guiding examples. Begins with the basic theory of probability and random variables; then develops the concepts of random vectors, sequences, and processes with their statistical description. Introduces basic statistics, regression analysis, parameter estimation, and hypothesis testing, including the use of computer simulations. Defines the concepts of correlation, covariance, and power density spectra. Uses these concepts to discuss noise, uncertainty, and other random phenomena, which is covered in the context of electrical and computer engineering applications.

**Prerequisite(s):** EECE 2150 with a minimum grade of D- ; MATH 2341 with a minimum grade of D-

**EECE 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EECE 4512. Healthcare Technologies: Sensors, Systems, and Analysis. (4 Hours)**

Examines healthcare technologies using both theory and hands-on approaches. Testing, imaging, and data collection are essential tools medical specialists use to treat patients and the primary contribution of engineers to healthcare. Covers the physics and physiology behind the newly defined concept of digital biomarkers; the electronics needed to collect these biomarkers; analysis techniques for processing and interpreting the data; and invasive (swallowable/implantable), on-body (wearable), and contactless systems for data collection. Examines safety issues, ethics, and regulatory hurdles from both an industry and research perspective. In the hands-on labs, offers students an opportunity to follow the steps of creating a startup or conducting new research and assembling a microcontroller-based sensor system for collecting digital biomarkers.

**Prerequisite(s):** EECE 2210 with a minimum grade of D- or EECE 2412 with a minimum grade of D- or BIOE 3210 with a minimum grade of D-

**EECE 4520. Software Engineering 1. (4 Hours)**

Offers an overview of the discipline of software engineering. Identifies the problems that one should expect when developing large software systems; methods that the software developer can use to deal with each of the problems; tools that the software developer can use; and procedures that can be followed in developing software. Covers the software life cycle (requirements analysis and specification, software design, coding, testing, and maintenance); various models of the software process—structured and agile; the Unified Modeling Language (UML) as applied to the software life cycle, prototyping, and documentation; design patterns; software metrics and estimation; software development environments and tools; and verification and validation. Includes a software development project that covers all the stages of the life cycle.

**Prerequisite(s):** CS 3000 with a minimum grade of D- or EECE 2560 with a minimum grade of D-

**EECE 4534. Microprocessor-Based Design. (4 Hours)**

Focuses on the hardware and software design for devices that interface with embedded processors. Topics include assembly language; addressing modes; embedded processor organization; bus design; electrical characteristics and buffering; address decoding; asynchronous and synchronous bus protocols; troubleshooting embedded systems; I/O port design and interfacing; parallel and serial ports; communication protocols and synchronization to external devices; hardware and software handshake for serial communication protocols; timers; and exception processing and interrupt handlers such as interrupt generation, interfacing, and auto vectoring.

**Prerequisite(s):** EECE 3324 with a minimum grade of D- or CS 3650 with a minimum grade of D-

**Corequisite(s):** EECE 4535

**EECE 4535. Lab for EECE 4534. (1 Hour)**

Accompanies EECE 4534. Consists of a comprehensive laboratory performed by a team of students. These laboratory exercises require students to design, construct, and debug hardware and software that runs on an embedded platform. Exercises are centered around a common embedded platform. The final exercise is a project that lets each group integrate hardware and software to realize a complete embedded design.

**Corequisite(s):** EECE 4534

**EECE 4574. Wireless Communication Circuits. (4 Hours)**

Covers the electronics of radio receivers and transmitters. Employs a commercial radio transceiver (MFJ-9340) as a learning tool. Presents basic topics (radio spectrum and its utilization, antennae, and information processing by modulation and demodulation). Studies building block realizations for modulators and demodulators for analog (AM, FM) and digital (ASK, PSK, FSK) radio. Covers common radio receiver architectures. Presents circuit-level designs of radio building blocks (resonators; L-C RF filters; crystals and IF filters; tuned transformers and impedance matching; amplifiers and power amplifiers; RF oscillators; mixers and up/down frequency conversion; signal detectors; and automatic gain control circuits). Includes receiver noise and sensitivity; transmitter range; spurious emissions and IM distortion; antennae and propagation in the atmosphere; wireless standards; multiple-access techniques; and software-defined radio. May include additional topics at instructor's discretion.

**Prerequisite(s):** EECE 2412 with a minimum grade of D-

**EECE 4604. Integrated Circuit Devices. (4 Hours)**

Offers a comprehensive introduction to the technology, theory, and applications of the most important electronic devices in today's integrated circuits. Topics include semiconductor electronic properties, Si fabrication technologies, p-n junctions, MOS capacitors, MOSFETS, metal-semiconductor contacts, and bipolar transistors. Emphasizes MOS devices, which are currently the dominant technology in integrated circuits. Introduces recent research trends in novel device concepts. Offers students who may pursue semiconductor process engineering, IC design, biomedical electronics, or research and development of microelectromechanical systems (MEMS) or optoelectronics devices an opportunity to obtain electronic device knowledge.

**Prerequisite(s):** EECE 2412 with a minimum grade of D-

**EECE 4630. Robotics. (4 Hours)**

Introduces robotics analysis covering basic theory of kinematics, dynamics, and control of robots. Develops students' design capabilities of microprocessor-based control systems with input from sensory devices and output actuators by having teams of students design and implement a small mobile robot system to complete a specific task, culminating in a competition at the end of the course. Covers actuators, sensors, system modeling, analysis, and motion control of robots.

**Prerequisite(s):** EECE 2160 with a minimum grade of D- ; EECE 2412 with a minimum grade of D-

**EECE 4632. Hardware-Software Codesign for FPGA-Based Systems. (4 Hours)**

Studies hardware and software design for embedded systems. Focuses on techniques to efficiently design and make use of field-programmable gate arrays (FPGAs) to accelerate applications. Specific topics include HW/SW codesign, buses and interfacing, C as a hardware description language, high-level synthesis, pipelining, hardware memory hierarchies, and computer arithmetic. Offers students an opportunity to program an embedded processor and interface to digital logic designs implemented on programmable hardware, as well as an opportunity to develop a series of designs in class, culminating in a project of the student's choosing. Potential project topics include (but are not limited to) computer vision, cryptography, machine learning, and wireless communications.

**Prerequisite(s):** EECE 2322 with a minimum grade of D-

**EECE 4638. Special Topics in Computer Engineering. (4 Hours)**

Focuses on advanced topics related to computer engineering technology to be selected by instructor. May be repeated without limit.

**EECE 4646. Optics for Engineers. (4 Hours)**

Presents the basic optical concepts necessary for an understanding of current and future optical communication, remote sensing, and industrial and biomedical systems. Topics include geometrical optics, polarized light, diffraction, and interference. Studies lasers and other light sources, optical fibers, detectors, CCD cameras, modulators, and other components of optical systems. Presents applications to specific systems such as fiber-optic communication, medical imaging systems, fiber-optic sensors, and laser radar.

**Prerequisite(s):** BIOE 3210 with a minimum grade of D- or EECE 2150 with a minimum grade of D- or EECE 2210 with a minimum grade of D- or PHYS 1155 with a minimum grade of D-

**EECE 4649. Biomedical Imaging Instrumentation. (4 Hours)**

Explores a wide variety of modalities for biomedical imaging in the pathology laboratory and in vivo. After an introductory discussion of tissue properties, waves used in imaging, and contrast mechanisms, the course discusses modalities such as microscopy, endoscopy, x-ray, computed tomography, ultrasound, and MRI. With each modality, instrument parameters, contrast mechanisms, resolution, and depth of penetration are considered. Offers students an opportunity to work in groups to complete a project in which they examine one modality in detail and either generate synthetic data using a computational model or process available image data.

**Prerequisite(s):** (MATH 1242 with a minimum grade of D- or MATH 1342 with a minimum grade of D- ); (PHYS 1145 with a minimum grade of D- or PHYS 1151 with a minimum grade of D- or PHYS 1171 with a minimum grade of D- )

**EECE 4694. Numerical Methods and Computer Applications. (4 Hours)**

Presents numerical techniques used in solving scientific and engineering problems with the aid of digital computers. Topics include theory of interpolation; the theory of numerical integration and differentiation, numerical solutions of linear as well as nonlinear systems of equations, the theory of least squares; and numerical solution of ordinary and partial differential equations using a programming environment such as MATLAB.

**Prerequisite(s):** MATH 2341 with a minimum grade of D- ; (GE 1111 with a minimum grade of D- or GE 1502 with a minimum grade of D- )

**EECE 4790. Electrical and Computer Engineering Capstone 1. (4 Hours)**

Requires students to select a project requiring design and implementation of an electrical, electronic, and/or software system, including evaluation of multiple constraints and use of appropriate engineering standards in the design; formation of a team to carry out the project; and submission and presentation of a detailed proposal for the work. Students must specify the materials needed for their project, provide a cost analysis, and make arrangements with their capstone adviser to purchase and/or secure donation of equipment. Requires students to perform a feasibility study by extensive simulation or prototype design of subsystems to facilitate the second phase of the capstone design, considering public health, safety and welfare, global, cultural, social, environmental, and economic factors.

**Prerequisite(s):** EECE 2322 with a minimum grade of D- or EECE 2412 with a minimum grade of D- or EECE 2520 with a minimum grade of D- or EECE 2530 with a minimum grade of D- or EECE 2540 with a minimum grade of D- or EECE 2560 with a minimum grade of D- or CS 3000 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov, NUpath Writing Intensive

**EECE 4791. Electrical and Computer Engineering Capstone 1. (1 Hour)**

Aims to give undergraduate engineering students significant experience in dealing with a senior design project. Students form teams and select a project requiring design and implementation of an electrical, electronic, and/or software system, including evaluation of multiple constraints, the use of appropriate engineering standards during the design to carry out the project, as well as the submission and presentation of a detailed proposal for the work. The project plan includes the consideration of public health, safety, and welfare and global, cultural, social, environmental, and economic factors. Students must specify a preliminary list of materials needed for their project, provide a cost analysis, and prepare and deliver written and oral presentations on the design proposal. This is the first of a two-course sequence.

**Prerequisite(s):** EECE 2322 with a minimum grade of D- or EECE 2412 with a minimum grade of D- or EECE 2520 with a minimum grade of D- or EECE 2530 with a minimum grade of D- or EECE 2540 with a minimum grade of D- or EECE 2560 with a minimum grade of D- or CS 3000 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov, NUpath Writing Intensive

**EECE 4792. Electrical and Computer Engineering Capstone 2. (4 Hours)**

Requires design and implementation of the project proposed in EECE 4791. Students are expected to apply engineering principles acquired throughout their academic and co-op experiences to the design of a system, component, or process. Each project includes the development and use of design methodology, formulation of design problem statements and specifications, construction of hardware, integration of sensors and actuators, programming microcontroller and software development, and design of subsystems, followed by testing and integration to validate the overall design. Projects include realistic constraints such as economic factors, safety, reliability, maintenance, aesthetics, ethics, and social impact. Students make oral presentations in a series of design reviews, document their final design solution in a written report, and demonstrate a functional prototype in a final presentation.

**Prerequisite(s):** EECE 4790 with a minimum grade of D- or EECE 4791 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov, NUpath Writing Intensive

**EECE 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EECE 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**EECE 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**EECE 5115. Dynamical Systems in Biological Engineering. (4 Hours)**

Provides an introduction to the theoretical analysis and modeling of dynamical systems in biology, ranging from molecular to population applications. Topics include difference and differential equation models, with basic theory including nondimensionalization, steady states, linearization, stability, eigenvalues, global behavior, singular perturbations, multistability, hysteresis, cooperativity, periodic solutions, excitable systems, bifurcations, and an introduction to spatial (PDE) models. Develops all concepts in the context of concrete biological applications, such as gene regulation, chemical reaction networks and stoichiometry, drug models and PK/PD, receptor/ligand interactions, synthetic constructs, action potential generation, enzymatic reactions, population interactions, epidemiology, epigenetic phenomena including differentiation, and transport, chemotaxis, and diffusion.

**Prerequisite(s):** MATH 2341 with a minimum grade of D- or graduate program admission

**EECE 5155. Wireless Sensor Networks and the Internet of Things. (4 Hours)**

Covers design and modeling of architectures, communication protocols, and algorithms for wireless sensor networks and the Internet of Things. Provides instruction in general aspects of wireless sensor networking, including protocol design, modeling, and simulation at all layers of the communication stack. Studies standardization efforts, including Bluetooth, IEEE 802.15.4/Zigbee, and SigFox/LoRa, among others. Culminates with illustrations of applications of sensor networks technology to many challenging problems of our times, including mobile crowdsensing, smart cities, and cyber-physical systems.

**Prerequisite(s):** EECE 2540 with a minimum grade of D- or CS 3700 with a minimum grade of D- or graduate program admission

**EECE 5161. Thin Film Technologies. (4 Hours)**

Covers the fundamentals of vacuum technology, thin film deposition technologies, characterization technologies, their applications in different industries, and the frontiers of research activities on thin film deposition technologies. Thin films are fundamental building blocks for integrated circuits chips, microelectromechanical systems (MEMS) devices, and nanoelectromechanical system devices (NEMS), etc., and play critical roles in determining the performance of IC circuits, MEMS, and NEMS devices. Topics include vacuum technologies; vacuum pumps; vacuum system design and analysis; different thin film deposition technologies, including sputtering, chemical vapor deposition, electrochemical deposition, atomic layer deposition, etc.; and different thin film characterization technologies, in particular the magnetic thin film characterization technologies, including VSM, PPMS, FMR, MOKE, etc. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** (MATH 1342 with a minimum grade of D- ; PHYS 1155 with a minimum grade of D- ) or graduate program admission

**EECE 5170. Introduction to Multiferroics Materials and Systems. (4 Hours)**

Offered by the NSF Nanosystems Engineering Research Center for Translational Applications of Nanoscale Multiferroic Systems (TANMS) and co-taught by professors from UCLA, UC Berkeley, Cornell, California State University Northridge, and Northeastern University. Course lectures will be available online for remote students. Covers introduction to multiferroics, atomic structure of multiferroics (chemistry), multiferroic material science, continuum-level analysis of multiferroic materials, and multiferroic devices.

**Prerequisite(s):** (MATH 2321 with a minimum grade of D- ; PHYS 1155 with a minimum grade of D- ; (CHEM 1151 with a minimum grade of D- or CHEM 1211 with a minimum grade of D- )) or graduate program admission

**EECE 5360. Combinatorial Optimization. (4 Hours)**

Introduces combinatorial optimization, an emerging field that combines techniques from applied mathematics, operations research, and computer science to solve optimization problems over discrete structures. Emphasizes problems that arise in the areas of electrical and computer engineering, including VLSI, computer-aided design, parallel computing, computer architecture, and high-performance compiling. Covers the foundations of algorithm analysis, including asymptotic notation and complexity theory, and a range of optimization techniques, including divide and conquer, local optimization, dynamic programming, branch and bound, simulated annealing, genetic algorithms, approximation algorithms, integer and linear programming, matroid theory, and greedy algorithms. Considers the efficient generation of optimal solutions, the development and evaluation of heuristics, and the computation of tight upper and lower bounds.

**Prerequisite(s):** EECE 2560 with a minimum grade of C- or CS 3000 with a minimum grade of C- or graduate program admission

**EECE 5512. Networked XR Systems. (4 Hours)**

Covers the emergence of augmented/virtual/mixed reality systems, broadly referred to as extended reality (XR), and the shift on the Internet to support shared experiences online. Covers hardware and software topics central to networked XR systems, including content capture, streaming, and display. Exposes students to some of the key tools required to digitize, optimize, render, control, and visualize content. Features hands-on assignments based on networked 3D cameras, XR headsets and browsers, telepresence applications, etc., as well as lectures spanning the ecosystem of topics central to networked XR systems. Connects all of these components to complete the cycle from reality to digital reality and back.

**Prerequisite(s):** EECE 2540 with a minimum grade of D- or graduate program admission

**EECE 5550. Mobile Robotics. (4 Hours)**

Investigates the science and engineering of mobile robots. Topics may include kinematics, dynamics, numerical methods, state estimation, control, perception, localization and mapping, and motion planning for mobile robots. Emphasizes practical robot applications ranging from disaster response to healthcare to space exploration.

**Prerequisite(s):** (EECE 2520 with a minimum grade of D- ; EECE 2560 with a minimum grade of D- ) or CS 3000 with a minimum grade of D- or graduate program admission

**EECE 5552. Assistive Robotics. (4 Hours)**

Investigates the what (modeling), how (design), and why (analysis) of assistive robotics through the use of model-based design process. System models are essential to four key aspects of the assistive robot design process: derivation of executable specifications, hardware and software design based on simulations, implementation by code generation, and continuous testing and verification. Topics may include modeling continuous and discrete dynamics, heterogeneous models, hybrid systems, stochastic models, models of computation, analysis and design of embedded control systems with applications in assistive robotics, system simulation, and validation and verification techniques. Course projects emphasize model-based design for control of assistive robots in smart environments.

**Prerequisite(s):** (EECE 2160 with a minimum grade of D- ; EECE 2520 with a minimum grade of D- ) or graduate program admission

**EECE 5554. Robotics Sensing and Navigation. (4 Hours)**

Examines the actual sensors and mathematical techniques for robotic sensing and navigation with a focus on sensors such as cameras, sonars, and laser scanners. These are used in association with techniques and algorithms for dead reckoning and visual inertial odometry in conjunction with GPS and inertial measurement units. Covers Kalman filters and particle filters as applied to the SLAM problem. A large component of the class involves programming in both the ROS and LCM environments with real field robotics sensor data sets. Labs incorporate real field sensors and platforms. Culminates with both an individual design project and a team-based final project of considerable complexity.

**Prerequisite(s):** ((MATH 3081 with a minimum grade of D- or EECE 3468 with a minimum grade of D- ); (EECE 2160 with a minimum grade of D- or EECE 2210 with a minimum grade of D- )) or graduate program admission

**EECE 5576. Wireless Communication Systems. (4 Hours)**

Examines fundamental principles of wireless system design, focusing on modern techniques used in cellular systems and wireless local area networks. Covers various levels of system design, from modulation/detection to traffic analysis. Introduces basics of radio propagation and studies their effect on communication signals. Special topics include spatial frequency reuse; call blocking and cellular system capacity; power control and hand-off strategies; channel access and sharing; orthogonal frequency division multiplexing (OFDM—a modulation technique used in WLAN and the fourth-generation [4G] cellular systems) and spread spectrum modulation (third-generation WCDMA systems); diversity techniques and multi-input multi-output (MIMO) signal processing. Requires an undergraduate course in communications systems.

**Prerequisite(s):** EECE 3400 with a minimum grade of D- or graduate program admission

**EECE 5578. Terahertz Communications. (4 Hours)**

Addresses technical aspects for the conception of the next generation of wireless networks, namely, 6G and beyond, in which the terahertz band (i.e., the frequencies between 100 GHz and 10 THz) plays a critical role. Provides a comprehensive view of the enabling technologies, challenges, and opportunities for terahertz communication networks, from innovative device concepts and propagation channel models to ultra-broadband communication and networking protocols. In-class lectures are combined with analytical, numerical and experimental homework assignments leveraging unique state-of-the-art capabilities in the Institute for the Wireless Internet of Things. Covered topics include terahertz device technologies, terahertz wave propagation and channel modeling, terahertz communications and signal processing, terahertz network architecture and protocol stack, and spectrum policy and standardization.

**Prerequisite(s):** EECE 2530 with a minimum grade of D- or EECE 3400 with a minimum grade of D- or graduate program admission

**EECE 5580. Classical Control Systems. (4 Hours)**

Introduces the analysis and design of classical control systems. Examines control system objectives, modeling and mathematical description, transfer function and state-variable representations, feedback control system characteristics, system responses, and stability of feedback systems. Also addresses compensator design based on root-locus and frequency response, and modern control system design using state-variable feedback.

**Prerequisite(s):** EECE 3464 with a minimum grade of D- or EECE 2520 with a minimum grade of D- or graduate program admission

**EECE 5582. Making Systems Reliable—An Introduction to Coding Theory. (4 Hours)**

Introduces modern approaches to ensuring reliable network communication, covering theory and use cases. After an accessible, engineering-centric introduction to Galois fields, presents erasure coding and decoding, with applications to protocols that reduce delays over links and networks (network coding) as well as post-quantum security. Considers error correction, starting with an overview of channel capacity and hard detection, as in storage systems. Introduces common codes (BCH, CRCs) with decoding using guessing random additive noise decoding, or GRAND, which can decode any code. Generalizes to using detector-generated information (soft information) and shows how GRAND can be extended to soft information systems, with examples such as CA-Polar and turbo decoding. Considers applications to reliable transport, communication, and storage of data.

**Prerequisite(s):** EECE 3468 with a minimum grade of D- or graduate program admission

**EECE 5606. Micro- and Nanofabrication. (4 Hours)**

Provides an overview of integrated circuit fabrication from the viewpoint of a process engineer. Offers students an opportunity to fabricate micro- and nanoscale devices in integrated lab sessions. Focuses on the physics, chemistry, and technology of integrated circuit fabrication in the lecture portion of the course, while students fabricate and test novel devices (an electrohydrodynamic micropump and three-dimensional carbon nanotube interconnects) in integrated lab sessions. Concentrates on silicon IC technology but also includes examples from other materials and device systems including microelectromechanical (MEMS) technologies that are used to build devices such as accelerometers, pressure sensors, and switches for telecommunications and other current examples provided from nanofabrication and nanotechnology. Lab hours are arranged.

**Prerequisite(s):** EECE 2412 with a minimum grade of D- or graduate program admission

**EECE 5608. Magnetic Materials for Next-Generation Electronics. (4 Hours)**

Covers the fundamentals of magnetic materials. Focuses on the frontiers of research activities on magnetic materials for next-generation sensors and electronics. Topics include magnetic units, magnetic materials classification, origin of ferromagnetism and ferrimagnetism, magnetic anisotropies, magnetostriction, magnetic domain theory, ferromagnetic/ferrimagnetic resonance, magnetodynamics, and magnetic material characterization techniques. Explores soft and hard magnetic materials and their applications, which include magnetic sensors, antennas, hard disk drives, magnetic materials for power supplies on chips, RF and microwave magnetic materials and devices, and spintronics. Also covers magnetic characterization techniques such as vibrating sample magnetometry, B-H looper, ferromagnetic resonance spectrometry, magneto-optic Kerr effect imaging, and magnetic sensing.

**Prerequisite(s):** (MATH 2321 with a minimum grade of D- ; (PHYS 1155 with a minimum grade of D- or PHYS 1165 with a minimum grade of D- )) or graduate program admission

**EECE 5610. Digital Control Systems. (4 Hours)**

Covers sampling and analysis tools for linear discrete-time dynamic systems, including the design of digital control systems using transform techniques by discrete equivalent and direct design methods; root locus, Bode and Nyquist diagrams, and Nichols charts; controller implementation issues, such as digital filter realizations, nonlinear effects due to quantization, round off, dead band, and limit cycles; and selection of the sampling rate.

**Prerequisite(s):** EECE 5580 with a minimum grade of C- or EECE 5580 with a minimum grade of D-

**EECE 5612. Statistical Inference: An Introduction for Engineers and Data Analysts. (4 Hours)**

Introduces fundamentals of statistical inference and data analysis through concepts of detection, estimation, and related signal processing algorithms. Addresses topics of hypothesis testing, Bayesian principles, multiple hypotheses and composite hypothesis testing, test power and uniformly powerful tests, likelihood functions, sufficient statistics, optimal estimation, bounds on the estimator variance, minimum variance linear estimation, prediction and regression, interval estimation, and confidence. Extraction of useful information from noisy observations and informed decision making are at the core of multiple disciplines ranging from traditional communications and sensor array processing to biomedical data analysis, pattern recognition and machine learning, security and defense, and financial engineering. Lectures are supported by illustrative examples, hands-on exercises, and numerical implementations grounded in real-world examples.

**Prerequisite(s):** (EECE 2520 with a minimum grade of D- ; (EECE 3468 with a minimum grade of D- or MATH 3081 with a minimum grade of D- ) or DS 5020 with a minimum grade of C- ) or graduate program admission

**EECE 5614. Reinforcement Learning and Decision Making Under Uncertainty. (4 Hours)**

Covers fundamentals of reinforcement learning. Begins with multiarmed bandit problems and basics of exploration and exploitation. Relates the key concepts of decision theory to dynamic programming and reinforcement learning. Discusses well-known off-policy and on-policy temporal difference learning methods. Connects reinforcement learning to key concepts in reasoning under uncertainty. Covers large-scale learning methods, including deep-value-based and policy-based methods. Explores reinforcement learning applications in robot navigation in uncertain and complex environments. Describes the applications of reinforcement learning in genomics and systems biology, including the derivation of intervention strategies for treating chronic diseases such as cancer.

**Prerequisite(s):** (EECE 3468 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MATH 2331 with a minimum grade of D- or IE 3412 with a minimum grade of D- ) or graduate program admission

**EECE 5626. Image Processing and Pattern Recognition. (4 Hours)**

Introduces processing and analysis of digital images with the goal of recognition of simple pictorial patterns. Topics include discrete signals and systems in 2D, digital images and their properties, image digitization, image enhancement, image restoration, image segmentation, feature extraction, object recognition, and pattern classification principles (Bayes rules, class boundaries) and pattern recognition methods.

**Prerequisite(s):** ((EECE 3464 with a minimum grade of D- or EECE 2520 with a minimum grade of D- ); (EECE 3468 with a minimum grade of D- or MATH 3081 with a minimum grade of D- )) or graduate program admission

**EECE 5639. Computer Vision. (4 Hours)**

Introduces topics such as image formation, segmentation, feature extraction, matching, shape recovery, dynamic scene analysis, and object recognition. Computer vision brings together imaging devices, computers, and sophisticated algorithms to solve problems in industrial inspection, autonomous navigation, human-computer interfaces, medicine, image retrieval from databases, realistic computer graphics rendering, document analysis, and remote sensing. The goal of computer vision is to make useful decisions about real physical objects and scenes based on sensed images. Computer vision is an exciting but disorganized field that builds on very diverse disciplines such as image processing, statistics, pattern recognition, control theory, system identification, physics, geometry, computer graphics, and learning theory. Requires good programming experience in Matlab or C++.

**EECE 5640. High-Performance Computing. (4 Hours)**

Covers accelerating scientific and other applications on computer clusters, many-core processors, and graphical processing units (GPUs). Modern computers take advantage of multiple threads and multiple cores to accelerate scientific and engineering applications. Topics covered include parallel computer architecture, parallel programming models, and theories of computation, as well as models for many-core processing. Highlights implementation of computer arithmetic and how it varies on different computer architectures. Includes an individual project where each student is expected to implement an application, port that application to several different styles of parallelism, and compare the results. Programming is done in variants of the C programming language.

**Prerequisite(s):** EECE 3324 with a minimum grade of D- or CS 3650 with a minimum grade of D- or graduate program admission

**EECE 5641. Introduction to Software Security. (4 Hours)**

Offers students an opportunity to learn how the security of systems can be violated and how such attacks can be detected and prevented. Computer security problems have a significant impact on practical aspects of our lives. Despite a considerable corpus of knowledge about tools and techniques to protect systems, information about actual vulnerabilities and how they are exploited is not generally available. Covers common programming, configuration, and design mistakes and examines possible protection and detection techniques. Uses examples to highlight general error classes. Includes a number of practical lab assignments that require students to apply their knowledge, as well as engage in a discussion of the current research in the field.

**Prerequisite(s):** ((EECE 2540 with a minimum grade of D- ; (EECE 4534 with a minimum grade of D- or EECE 3324 with a minimum grade of D- )) or (CS 3650 with a minimum grade of D- ; (CS 3700 with a minimum grade of D- or EECE 2540 with a minimum grade of D- )) or (EECE 7205 with a minimum grade of C- or EECE 7376 with a minimum grade of C- or CS 5600 with a minimum grade of C- ))

**EECE 5642. Data Visualization. (4 Hours)**

Introduces relevant topics and concepts in visualization, including computer graphics, visual data representation, physical and human vision models, numerical representation of knowledge and concept, animation techniques, pattern analysis, and computational methods. Topics include tools and techniques for practical visualization and elements of related fields, including computer graphics, human perception, computer vision, imaging science, multimedia, human-computer interaction, computational science, and information theory. Covers examples from a variety of scientific, medical, interactive multimedia, and artistic applications. Includes hands-on exercises and projects. Emphasizes modern engineering applications of computer vision, graphics, and pattern classification methodologies for data visualization.

**EECE 5643. Simulation and Performance Evaluation. (4 Hours)**

Covers topics on computer simulation and performance evaluation in computer systems. Introduces basic computational and mathematical techniques for modeling, simulating, and analyzing the performance by using simulation, including models, random number generation, statistics analysis, and discrete event-driven simulation. Also covers both classic and timely techniques in the area of performance evaluation, including workload characterization, capacity planning, and resource management in enterprise systems, computer networks, data centers, and cloud computing.

**Prerequisite(s):** EECE 3326 with a minimum grade of D- or EECE 2560 with a minimum grade of D- or CS 3000 with a minimum grade of D- or graduate program admission

**EECE 5644. Introduction to Machine Learning and Pattern Recognition. (4 Hours)**

Studies machine learning (the study and design of algorithms that enable computers/machines to learn from experience/data). Covers a range of algorithms, focusing on the underlying models between each approach. Emphasizes the foundations to prepare students for research in machine learning. Topics include Bayes decision theory, maximum likelihood parameter estimation, model selection, mixture density estimation, support vector machines, neural networks, probabilistic graphics models, and ensemble methods (boosting and bagging). Offers students an opportunity to learn where and how to apply machine learning algorithms and why they work.

**Prerequisite(s):** EECE 3468 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MATH 1215 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or IE 3412 with a minimum grade of D- or CIVE 3464 with a minimum grade of D- or BIOE 2365 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or graduate program admission

**EECE 5645. Parallel Processing for Data Analytics. (4 Hours)**

Covers the fundamentals of parallel machine-learning algorithms, tailored specifically to learning tasks involving large data sets. Reviews methods for dealing with both large and high-dimensional data sets, emphasizing distributed implementations. Beyond covering the theory behind statistical data analysis, the course also offers a hands-on approach, using Spark as a development platform for parallel learning. Topics include, Apache Spark fundamentals, multithreaded/cluster execution, resilient distributed data structures, map-reduce operations, using key-value pairs, joins, convex optimization, gradient descent, linear regression, Gauss-Markov theorem, ridge and lasso regularization, feature selection, cross validation, variance vs. bias trade-off, classification, logistic regression, ROC curves and AUC, matrix and tensor factorization, graph-parallel algorithms and sparsity, Perceptron algorithm, and deep neural networks.

**Prerequisite(s):** ((MATH 3081 with a minimum grade of D- or EECE 3468 with a minimum grade of D- ); (EECE 2560 with a minimum grade of D- or CS 3000 with a minimum grade of D- or CS 4800 with a minimum grade of D- )) or EECE 5644 with a minimum grade of C- or DS 5220 with a minimum grade of C- or DS 5230 with a minimum grade of C-

**EECE 5647. Nanophotonics. (4 Hours)**

Introduces basic concepts and recent developments in nanophotonic materials and devices. Nanophotonics is one very important research area in nanotechnology. Discusses the fundamentals of electromagnetics (Maxwell's equations, polarization, wave propagations, etc.); quantum mechanics; and typical nanofabrication and characterization techniques. Focuses on specific topics in nanophotonics, including silicon photonics; photonic crystals; plasmonics and optical metamaterials, with their diverse applications in optical circuits; imaging; optical trapping; biomedical sensing; and energy harvesting. Offers students an opportunity to obtain a fundamental understanding of the property and manipulation of light at the nanoscale.

**Prerequisite(s):** EECE 3440 with a minimum grade of D- or EECE 2530 with a minimum grade of D- or graduate program admission

**EECE 5649. Design of Analog Integrated Circuits with Complementary Metal-Oxide-Semiconductor Technology. (4 Hours)**

Covers theoretical analysis, practical design, and simulation of analog integrated circuits implemented in complementary metal-oxide-semiconductor (CMOS) fabrication process technologies. Introduces cadence tools for circuit simulations, physical layout, and layout verification. Begins with basic concepts such as CMOS device models, DC and small-signal analysis techniques for single- and multistage amplifiers, biasing configurations, and reference generation circuits. Explores differential signal processing, operational amplifiers, operational transconductance amplifiers, and common-mode feedback circuits. Analysis methods include the evaluation of linearity, noise, stability, and device mismatches from process variations. Addresses some advanced design techniques, such as linearity improvement methods, frequency compensation, and digitally assisted performance tuning.

**Prerequisite(s):** EECE 3410 with a minimum grade of D- or graduate program admission

**EECE 5651. Introduction to Photonic Devices. (4 Hours)**

Introduces fundamentals of photonic devices and guided-wave optoelectronics. Photonic devices play a key role in long-haul telecommunications, datacom/high-performance computing, as well as quantum communication and computation. Introduces basics of passive and active components used in these applications with coverage of electromagnetic and fiber optics, dielectric waveguides, photonic integrated circuit (PIC) technology, sources (semiconductor lasers), and photon detectors and external modulators (electro- and acousto-optic).

**Prerequisite(s):** (EECE 2530 with a minimum grade of D- ; MATH 2341 with a minimum grade of D-) or graduate program admission

**EECE 5652. Microwave Circuits and Systems. (4 Hours)**

Addresses novel applications of analytical and engineering techniques for RF/microwave circuits, in addition to transmission lines, impedance matching, S-parameters, high-frequency circuit analysis, power dividers, resonators, filters, amplifier, and nonlinear components. Emphasizes fundamental concepts, essential mathematical formulas and theorems, and engineering applications. Provides ample examples to offer participants an opportunity to fully appreciate the power of the techniques described and gain extensive experience in the area of high-frequency circuits, from theory formulation to novel engineering designs.

**Prerequisite(s):** ((EECE 2150 with a minimum grade of D- or EECE 2210 with a minimum grade of D- or BIOE 3210 with a minimum grade of D- ); (EECE 2530 with a minimum grade of D- )) or graduate program admission

**EECE 5653. Introduction to Quantum Engineering. (4 Hours)**

Introduces the fundamental principles of quantum mechanics and their applications to emerging quantum technologies such as quantum computation, secure quantum communications, and quantum-enhanced sensing. Covers the description of simple quantum systems such as harmonic oscillators using Schrodinger's equation and operator formalism; the use of quantum platforms such as photons to encode qubits; generating and characterizing entanglement; and the implementation of quantum circuits for quantum computation and communication algorithms such as teleportation, entanglement swapping, and factoring. Emphasizes the foundations to prepare students for research in quantum devices and their applications to quantum information sciences.

**Prerequisite(s):** MATH 2341 with a minimum grade of D- or graduate program admission

**EECE 5654. Design and Prototyping of Optical Systems for Engineering Applications. (4 Hours)**

Studies how to design optics experiments and instrument prototypes on the benchtop, as well as to fabricate and test them in a laboratory environment. Discusses application areas including biomedical imaging; astronomy; LiDAR; remote sensing; environmental monitoring; semiconductor fabrication; optical communication; optical computing; military imaging; tracking; and guidance, solar energy, and imaging systems for robotics, security, and transportation. Illustrates how to apply the most important and common equations of optics to design of systems that meet specifications and to evaluation of their performance.

**Prerequisite(s):** ((BIOE 3210 with a minimum grade of D- or EECE 2150 with a minimum grade of D- or EECE 2210 with a minimum grade of D- ); (EECE 4646 with a minimum grade of D- or EECE 2530 with a minimum grade of D- )) or graduate program admission

**EECE 5665. Signal Processing for Global Navigation Satellite Systems. (4 Hours)**

Introduces global navigation satellite systems (GNSS), covering the fundamental aspects of operation. Emphasizes receiver design, although onboard satellite aspects are also discussed, such as the different signals and GNSS constellations (focusing on GPS and Galileo). Offers students an opportunity to gain basic knowledge of the underlying principles of GNSS, while learning how to apply tools of statistical signal processing from detection, estimation, and filtering theories to a real-world engineering application. Topics include notions in GNSS history, constellations and signals, propagation channel and main impairments, RF front-end architectures, signal acquisition, signal tracking, position calculation and integrity measures, sensor hybridization and data fusion, and identification of the most challenging scenarios of operation.

**Prerequisite(s):** ((BIOE 3210 with a minimum grade of C- or EECE 2150 with a minimum grade of C- or EECE 2210 with a minimum grade of C-); EECE 2520 with a minimum grade of C- ; MATH 2341 with a minimum grade of C- ; (EECE 3468 with a minimum grade of C- or MATH 3081 with a minimum grade of C- )) or graduate program admission

**EECE 5666. Digital Signal Processing. (4 Hours)**

Presents the theory and practice of modern signal processing techniques. Topics include the characteristics of discrete signals and systems, sampling, and A/D conversion; the Z-transform, the Fourier transform, and the discrete Fourier transform; fast Fourier transform algorithms; design techniques for IIR and FIR digital filters; and quantization effects in digital signal processing. Graduate students may register for this course only if they did not complete an undergraduate course in digital signal processing; such graduate registration requires approval of instructor and an internal departmental petition.

**Prerequisite(s):** ((ME 4555 with a minimum grade of D- or EECE 2520 with a minimum grade of D- ); EECE 3468 with a minimum grade of D- ) or graduate program admission

**EECE 5668. Large Language Models. (4 Hours)**

Explores the foundations, methodologies, and applications of large language models (LLMs), cutting-edge systems reshaping the field of artificial intelligence. Covers core topics including model architectures, training objectives, fine-tuning strategies, prompt engineering, evaluation metrics, and challenges such as bias, fairness, and interpretability. Highlights real-world uses of LLMs in tasks such as text generation, translation, summarization, and reasoning. Offers opportunities to examine recent research and trends driving the rapid evolution of LLMs. Emphasizes both theoretical understanding and practical applications using widely adopted tools and libraries for developing and deploying LLMs. Encourages critical thinking about the societal implications of deploying these models at scale.

**Prerequisite(s):** CS 6140 with a minimum grade of C- or DS 4400 with a minimum grade of D- or EECE 5644 with a minimum grade of C- or EECE 5644 with a minimum grade of D-

**EECE 5670. Sustainable Energy: Materials, Conversion, Storage, and Usage. (4 Hours)**

Examines, in this interdisciplinary course, modern energy usage, consequences, and options to support sustainable energy development from a variety of fundamental and applied perspectives. Emphasizes both (1) physical and chemical processes in materials for the conversion of energy and (2) how to design a system with renewable energy for applications such as electricity generation and transmission. Takes a systems analysis point of view. Topics include energy conservation; fossil fuels; and energy conversion methods for solar, geothermal, wind, hydro, bioenergy, electrochemical, and similar methods.

**EECE 5680. Electric Drives. (4 Hours)**

Examines all subsystems that comprise an electric drive including electric machines, power electronic converters, mechanical system requirements, feedback controller design, and interactions with utility systems. Based on an integrative approach that requires minimal prerequisites: a junior-level course in signals and systems and some knowledge of electromagnetic field theory (possibly from physics classes), and does not require separate courses in electric machines, controls, or power electronics.

**Prerequisite(s):** ((EECE 3440 with a minimum grade of D- or EECE 2530 with a minimum grade of D- ); (EECE 3464 with a minimum grade of D- or EECE 2520 with a minimum grade of D- )) or graduate program admission

**Corequisite(s):** EECE 5681

**EECE 5681. Lab for EECE 5680. (0 Hours)**

Accompanies EECE 5680. Covers topics from the course through various experiments.

**Corequisite(s):** EECE 5680

**EECE 5682. Power Systems Analysis 1. (4 Hours)**

Covers fundamentals including phasors, single-phase and balanced three-phase circuits, complex power, and network equations; symmetrical components and sequence networks; power transformers, their equivalent circuits, per unit notation, and the sequence models; transmission line parameters including resistance, inductance, and capacitance for various configurations; steady-state operation of transmission lines including line loadability and reactive compensation techniques; power flow studies including Gauss-Speidel and Newton Raphson interactive schemes; symmetrical faults including formation of the bus impedance matrix; and unsymmetrical faults including line-to-ground, line-to-line, and double line-to-ground faults.

**Prerequisite(s):** EECE 3440 with a minimum grade of D- or EECE 2530 with a minimum grade of D- or graduate program admission

**EECE 5684. Power Electronics. (4 Hours)**

Provide tools and techniques needed to analyze and design power conversion circuits that contain switches. The first part of the course emphasizes understanding and modeling of such circuits, and provides a background for engineering evaluation of power converters. The second part covers dynamics and control of this class of systems, enabling students to design controllers for a variety of power converters and motion control systems. Addresses a set of analytical and practical problems, with emphasis on a rigorous theoretical treatment of relevant questions. Designed for students with primary interests in power conditioning, control applications, and electronic circuits, but it could prove useful for designers of high-performance computers, robots, and other electronic and electromechanical (mechatronic) systems in which the dynamical properties of power supplies become important.

**Prerequisite(s):** (EECE 2412 with a minimum grade of D- ; (EECE 3464 with a minimum grade of D- or EECE 2520 with a minimum grade of D- )) or graduate program admission

**Corequisite(s):** EECE 5685

**EECE 5685. Lab for EECE 5684. (0 Hours)**

Accompanies EECE 5684. Covers topics from the course through various experiments.

**Corequisite(s):** EECE 5684

**EECE 5686. Electrical Machines. (4 Hours)**

Reviews phasor diagrams and three-phase circuits; the magnetic aspects including magnetic circuits and permanent magnets; transformers, their equivalent circuits, and performance; principles of electromechanical energy conversion; elementary concepts of rotating machines including rotating magnetic fields; and steady-state theory and performance of induction machines, synchronous machines, and direct current machines.

**Prerequisite(s):** EECE 2530 with a minimum grade of D- or graduate program admission

**EECE 5688. Analysis of Unbalanced Power Grids. (4 Hours)**

Examines common types of power system faults. Starts with a detailed description of three-phase modeling of basic power system elements such as transmission lines, transformers, and generators. Then presents fundamentals of three-phase circuit analysis in the steady state, both for balanced and unbalanced operating conditions. Uses symmetrical component transformation and positive, negative, and zero sequence networks to analyze unbalanced systems. Presents methods to calculate fault currents and postfault bus voltages. Reviews basic protective relaying and relay settings using typical distribution system examples.

**Prerequisite(s):** EECE 2150 with a minimum grade of D- or graduate program admission

**EECE 5690. Electric Vehicle Powertrains. (4 Hours)**

Designed to familiarize students with electric vehicle powertrains. Covers different types of energy storage elements used in EV and hybrid electric vehicles, bidirectional DC-DC converters and their control, inverters, different power converter topologies for onboard charging, wireless power transfer for battery charging, and different types of electric motors that are used in EVs.

**Prerequisite(s):** (EECE 2412 with a minimum grade of D- ; EECE 2530 with a minimum grade of D- ) or graduate program admission

**EECE 5692. Antennas for Wireless Communication and Sensing. (4 Hours)**

Introduces the fundamental physical principles for the electromagnetic radiation from antennas. Presents the most important mathematical techniques for the analysis of the radiation. Applies these principles and techniques to practical antenna systems. Starting with the fundamental parameters of the antennas, introduces the vector potentials and the theorems that are needed for the derivation of the radiation integrals from Maxwell's equations and formulates various antenna radiation characteristics. Covers the applications of practical antennas, wireless communications and networks, space antennas, bio and wearable antennas, and optical antennas, to name a few.

**Prerequisite(s):** EECE 2530 with a minimum grade of D- or graduate program admission

**EECE 5693. Electromagnetic Devices for RF and Wireless Communications. (4 Hours)**

Introduces some of the unique electromagnetic devices integrated in current and future technologies in the field of electromagnetics. These devices have impacted various disciplines including wireless systems, radar and space research, photonics, and bio and medical imaging. Covers transmission lines, RF/microwave circuits, high-frequency power dividers, and filters components. Discusses the translational area of antennas and wireless systems, radiation synthesis, and array antennas. Discusses some photonic components, as well as emerging applications such as antennas for 5G, massive MIMO (multiple-input and multiple-output) wireless antennas, and wearable sensors.

**Prerequisite(s):** EECE 2530 with a minimum grade of D- or graduate program admission

**EECE 5697. Acoustics and Sensing. (4 Hours)**

Introduces the fundamental concepts of acoustics and sensing with waves. Offers a unified theoretical approach to the physics of image formation through scattering and wave propagation in sensing. Topics include the linear and nonlinear acoustic wave equation; sources of sound; reflection, refraction, transmission, and absorption; bearing and range estimation by sensor array processing, beam forming, matched filtering, and focusing; diffraction, bandwidth, ambient noise, and reverberation limitations; scattering from objects, surfaces, and volumes by Green's theorem; forward scatter, shadows, Babinet's principle, extinction, and attenuation; ray tracing and waveguides in remote sensing; and applications to acoustic, radar, seismic, thermal, and optical sensing and exploration.

**Prerequisite(s):** EECE 3464 with a minimum grade of D- or EECE 2520 with a minimum grade of D- or graduate program admission

**EECE 5698. Special Topics in Electrical and Computer Engineering. (4 Hours)**

Covers special topics in electrical and computer engineering. Topics are selected by the instructor and vary from semester to semester. May be repeated up to four times.

**EECE 5699. Computer Hardware and System Security. (4 Hours)**

Introduces computer hardware and system security. Covers state-of-the-art hardware security and trust issues, including a hands-on lab session to implement various hardware security attacks. Topics include applied cryptography, side-channel attacks, differential power analysis, fault injection and analysis, cache side-channel attacks (Meltdown and Spectre), acoustic analysis, and hardware security primitives (physical unclonable function and random number generator).

**Prerequisite(s):** EECE 3324 (may be taken concurrently) with a minimum grade of D- or CS 3650 (may be taken concurrently) with a minimum grade of D- or CS 5600 (may be taken concurrently) with a minimum grade of D- or graduate program admission

**EECE 6400. Special Problems in Electrical and Computer Engineering. (1-4 Hours)**

Delves deeply, in collaboration with a faculty member, into a specialized subject typically not covered extensively in the standard electrical and computer engineering curriculum. The topic may involve analysis, experimentation, computational methods, or a blend of these approaches. Potential outcomes include producing a comprehensive report, gathering experimental data, or designing and evaluating algorithms.

**EECE 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EECE 7105. Optics for Engineers. (4 Hours)**

Introduces optics, presenting the engineering concepts necessary to understand and evaluate electro-optical systems. Begins with a brief but rigorous treatment of geometric optics, including matrix methods, aberrations, and pupils and windows, with practical examples of optical instruments and electro-optical systems. Topics include polarization; interference; diffraction; and optical properties of crystals, thin films, optical resonators, guided waves, modulators, and detectors. Presents concepts with examples from modern optical systems such as LiDAR, fiber-optical sensors, range finders, infrared systems, and optical communication systems. Requires a bachelor of science in engineering or physics.

**EECE 7150. Autonomous Field Robotics. (4 Hours)**

Examines the role of software and hardware in the design and use of real autonomous systems, including autonomous cars, autonomous underwater vehicles, and unmanned aerial systems. Focuses on using real large-scale robotics systems in real-world settings.

**Prerequisite(s):** EECE 5554 with a minimum grade of C-

**EECE 7200. Linear Systems Analysis. (4 Hours)**

Covers fundamental algebraic concepts and algebraic structures. Topics include linear operators and their representations; matrices, algebraic equations, equivalence, and similarity transformations; introduction to the state-variable theory of continuous and discrete linear systems; standard canonical representations, the concept of state, and the representation of interconnected systems, linear spaces, the state equations, and their solution; stability; and introduction to the general control problem in terms of controllability and observability.

**EECE 7201. Solid State Devices. (4 Hours)**

Covers the fundamental elements of solid-state device physics and the application of these principles. Seeks to provide students with the opportunity to develop an understanding of pn junctions, bipolar junction transistors, and MOSFETs.

**EECE 7202. Electromagnetic Theory 1. (4 Hours)**

Examines the fundamental equations, their physical meaning, principal mathematical techniques, and important engineering applications. Topics include sources of the electromagnetic field, Lorentz force equation, integral form of Maxwell's equations and point relations (differential equations and boundary conditions), electromagnetic energy and power, propagation of uniform and nonuniform plane waves in homogeneous media, reflection and refraction, scalar and vector potentials, solutions in the absence of boundaries for static and dynamic problems, solutions to boundary value problems, duality, uniqueness, images, physical theory of diffraction, and general theory of metal and dielectric wave-guides and resonators for Cartesian and cylindrical systems.

**EECE 7203. Complex Variable Theory and Differential Equations. (4 Hours)**

Comprises the theory of functions of a complex variable. Covers Cauchy's integral and related theorems, Taylor and Laurent series, analytic continuation, and multivalued functions. Considers special functions of mathematical physics using generating functions, Taylor and Laurent expansions, and various integral representations. Reviews applications of complex variable theory drawn from optics and electromagnetic theory and from digital signal processing and digital communications. Focuses on the theory of ordinary and partial differential equations of mathematical physics. Develops series solutions of ordinary differential equations of second order using the tools of complex variable theory. Covers Sturm-Liouville theory and uses it to develop eigen function and Green function solutions of homogeneous and inhomogeneous partial differential equations. Requires knowledge of undergraduate advanced calculus.

**EECE 7204. Applied Probability and Stochastic Processes. (4 Hours)**

Covers the fundamentals of probabilistic treatment and the concept of random processes, which are essential for many engineering disciplines and data analysis in general. Includes the basic laws of probability, random variables and their functions, probability density and cumulative distributions, statistical averages, bounds on probability, and the central limit theorem. Outlines basic principles of statistics, including estimation of probability, confidence intervals, and order statistics. Provides an overview of detection and estimation problems, including maximum likelihood and Bayesian principles, Cramer-Rao bound, linear estimators, and hypothesis testing. Studies random sequences, with notions of convergence, laws of large numbers, and examples of Markov chains. Defines random processes, along with the concepts of stationarity, ergodicity, autocorrelation and power spectral density, and filtering operations.

**EECE 7205. Fundamentals of Computer Engineering. (4 Hours)**

Introduces fundamental techniques in computer engineering used throughout the graduate curriculum. Covers basic programming and analysis methods and the formulation and solution of a wide range of computer engineering problems. Also discusses the applications of algorithm analysis and complexity theory to analyzing and solving problems. Emphasizes those fundamental computational problems and related algorithms whose solution can be obtained in polynomial time. For basic computational problems such as sorting, searching, elementary graph algorithms, shortest-paths problems, as well as flow problems in networks, many different algorithms and data structures are described and analyzed, implemented, and compared both from a theoretical and from an experimental point of view.

**EECE 7211. Nonlinear Control. (4 Hours)**

Discusses phase plane analysis for nonlinear systems. Topics include fundamentals of Lyapunov theory; absolute stability, passivity, averaging, singular perturbation, input-output stability, and other advanced stability topics; describing functions; nonlinear control methods based on linearization, feedback linearization, sliding control, Lyapunov, and passivity and center manifold theory and bifurcations.

**Prerequisite(s):** EECE 7200 with a minimum grade of C-

**EECE 7213. System Identification and Adaptive Control. (4 Hours)**

Discusses fundamental issues of adaptive identification and control, such as stability of adaptive systems, convergence, persistent excitation, and robustness. Identification is the process of mathematically modeling a system based on measurement data that may be limited or uncertain. Adaptive control, then, is the means by which a system that is poorly modeled is controlled adequately. Enhances the underlying basic ideas that are essential for adaptive control. Emphasizes recursive approaches, such as recursive least squares algorithm, where parameter estimates are updated in real time. Covers simple adaptive systems, adaptive observers, and adaptive control. Discusses in detail two major adaptive schemes, model reference adaptive control (MRAC) and self-tuning regulators (STR).

**Prerequisite(s):** EECE 7200 with a minimum grade of C-

**EECE 7214. Optimal and Robust Control. (4 Hours)**

Explores state-space, time-domain techniques for analyzing and designing optimal and robust linear control systems. Introduces basic concepts of dynamic optimization and applies them to problems of short-term and long-term optimal control, path planning and stabilization, state estimation, and filtering. Emphasizes linear quadratic optimization, H<sub>2</sub> control, H-infinity control, and mu-synthesis. Reviews pertinent linear systems concepts and discusses connections with a geometric intuition relating quadratic optimization to projections.

**Prerequisite(s):** EECE 7200 with a minimum grade of C-

**EECE 7215. Introduction to Distributed Intelligence. (4 Hours)**

Introduces distributed intelligence (complex distributed networks), their structure, and function, with examples from engineering, applied mathematics, and social sciences. Topics include spectral graph theory, notions of centrality, random graph models, contagion phenomena and epidemics, cascades and diffusion, game theory, and opinion dynamics.

**Prerequisite(s):** EECE 5580 with a minimum grade of C- or EECE 7346 with a minimum grade of C-

**EECE 7223. Riemannian Optimization. (4 Hours)**

Offers a self-contained introduction to optimization on smooth manifolds. Covers both theoretical foundations and practical computational methods that students can apply to their own work. Introduces the theory of Riemannian geometry. Emphasizes those elements that are relevant for the construction of optimization algorithms (tensor fields, metrics, connections, geodesics, retractions, and transporters). Applies this geometric machinery to devise first- and second-order smooth optimization methods on generic Riemannian manifolds. Focuses on the development of practical computational techniques, with applications to robotics, computer vision, and machine learning.

**EECE 7224. Power Systems State Estimation. (4 Hours)**

Offers an up-to-date account of the strategies utilized in state estimation of electric power systems. Provides a broad overview of power system operation and the role of state estimation in overall energy management. Presents an abundance of examples, models, tables, and guidelines to clearly examine new aspects of state estimation, the testing of network observability, and methods to assure computational efficiency.

**EECE 7226. Modeling and Simulation of Power System Transients. (4 Hours)**

Presents computer modeling of linear and nonlinear power system components to be used in transient studies. Covers methods of digital simulation of power systems operating in the steady-state and transient conditions. Discusses use of transient simulation programs for design and analysis of power systems. Students are asked to carry out a term project and deliver a presentation about its outcome.

**EECE 7240. Analog Integrated Circuit Design. (4 Hours)**

Treats the analysis and design of analog ICs, their functional performance, and applications. Focuses on the various building blocks of analog circuits, their operation, and the underlying principles and techniques, with analysis supplemented by CAD simulation. Topics include modeling and layout of CMOS, bipolar, BiCMOS devices, and passive components; DC building blocks, including precision current and voltage references; performance analysis of signal gain, impedances, and frequency response and speed of basic/compound amplifier structures; architectures of operational amplifiers, including low-voltage, OTAs, and three-stage designs; feedback and performance merits, topologies, instability, and frequency compensation of feedback amplifiers; nonlinear and analog computation IC functions; noise in ICs, physical origins and device modeling, noise circuit analysis, SNR and NF, and techniques for the enhancement of system noise performance.

**Corequisite(s):** EECE 7248

**EECE 7244. Introduction to Microelectromechanical Systems (MEMS). (4 Hours)**

Introduces microelectromechanical systems, including principles of sensing and actuation, microfabrication technology for MEMS, noise concepts, and packaging techniques. Covers a wide range of disciplines, from electronics to mechanics, material properties, microfabrication technology, electromagnetics, and optics. Studies several classes of devices including inertial measurement devices, pressure sensors, rf components, and optical MEMS. Devotes the last third of the semester largely to projects involving design of MEMS devices to specifications in a realistic fabrication process.

**EECE 7245. Microwave Circuit Design for Wireless Communication. (4 Hours)**

Covers planar microwave circuits and integrated circuits (MMICs) for wireless communication systems. Employs microwave CAD tools in design projects as well as in-class case-study examples. Reviews communication system basics, modulation and demodulation, architectures of receivers and transmitters, and system performance. Covers planar transmission lines and coupled lines and their application to important devices and microwave circuit functions and multiport networks using S-parameters, flow graphs, and Smith charts. Studies microwave filters, narrowband and broadband amplifiers, their gain and stability, impedance matching, and noise performance, as well as mixers and frequency-conversion techniques. Finishes with design and performance of microwave oscillators. Covers wireless standards, multiple-access techniques, and recent advances if time permits.

**EECE 7247. Radio Frequency Integrated Circuit Design. (4 Hours)**

Introduces radio frequency (RF) integrated circuit analysis, design, and simulation methods with an emphasis on CMOS implementations. Covers basic RF design concepts including linearity, noise figure, sensitivity, impedance matching, and imperfections of integrated passive components (parasitics, quality factors). Discusses front-end circuit design considerations for low-noise amplifiers, mixers, oscillators, and power amplifiers.

**Prerequisite(s):** EECE 7240 with a minimum grade of C- or EECE 5649 with a minimum grade of C- or EECE 5649 with a minimum grade of D-

**EECE 7248. Lab for EECE 7240. (0 Hours)**

Accompanies EECE 7240. Covers topics from the course through various experiments.

**Corequisite(s):** EECE 7240

**EECE 7250. Power Management Integrated Circuits. (4 Hours)**

Presents power management circuits with a focus on modern system on a chip (SoC). Introduces linear regulators, switching converters, switched-capacitor converters, voltage references, energy harvesters, and battery chargers. Studies various control methods, design trade-offs, and performance metrics in the context of an SoC. Introduces emerging energy-harvesting techniques for IC design. After completing this course, the successful student should be able to design, characterize, choose, or specify power-management circuits or ICs for a system.

**Prerequisite(s):** EECE 5649 with a minimum grade of D- or EECE 5649 with a minimum grade of C- (Graduate) or EECE 7240 with a minimum grade of C-

**EECE 7268. Verifiable Machine Learning. (4 Hours)**

Introduces verifiable machine learning, focusing on the limitations of current learning-based methods regarding safety and robustness. Explores adversarial robustness, uncertainty quantification, safety verification, reachability analysis, and safe/robust reinforcement learning. Examines neural network relaxations and their applications in robotics, control, image classification, medical diagnosis, and language modeling.

**EECE 7270. Electromagnetic Theory 2. (4 Hours)**

Continues EECE 7202. Examines important electrodynamic applications by the use of advanced mathematical techniques. Topics include general theory of wave-guides and resonators with application to the cylindrical geometry; dielectric rod wave-guide; optical fibers; radiation; linear antennas; loop antenna; linear arrays; ray optics; scattering and diffraction of waves for planar, cylindrical, and spherical geometries; and effects of random media.

**Prerequisite(s):** EECE 7202 with a minimum grade of C-

**EECE 7271. Computational Methods in Electromagnetics. (4 Hours)**

Presents solutions to problems in electromagnetics using a wide variety of numerical and computational methods. Discusses in detail the finite difference approximations of partial differential equations and the finite difference time-domain method of simulating electromagnetic wave propagation and scattering. Uses moment methods to solve the integral equations related to currents and charges on wire structures. Uses finite element and higher-order finite difference methods to solve problems in electrostatics and wave propagation. Discusses efficient matrix methods, relaxation methods, the conjugate gradient technique, and multidimensional Newton's method in the context of electromagnetic field simulation.

**Prerequisite(s):** EECE 7202 with a minimum grade of C-

**EECE 7275. Antennas and Radiation. (4 Hours)**

Presents the fundamental theory and properties of antennas. Topics include equivalence, reciprocity, uniqueness, Huygen's principle, antenna impedance, and diffraction; linear, loop, array, and aperture antennas including horns, reflectors, lenses, and microstrip; transmitting and receiving antennas and transmission formulas; and numerical antenna analysis methods.

**Prerequisite(s):** EECE 7202 with a minimum grade of C-

**EECE 7284. Optical Properties of Matter. (4 Hours)**

Presents the formal mathematical treatment of classical crystal optics including dispersion, polarization, birefringence, metal optics, and the optics of thin films. Emphasis is on the interaction of electromagnetic waves and the crystal lattice. Classical crystal optics are extended to nonlinear effects observed with very intense electric and magnetic fields. Presents applications of nonlinear optics, such as second- and third-harmonic generation, optical mixing, optical parametric oscillation, multiple photon interaction, and linear and nonlinear scattering. Various topics in linear and nonlinear optics are applied in such areas as birefringent filters, second-harmonic generators, optical parametric oscillators, and acousto-optical beam deflectors.

**EECE 7293. Modern Imaging. (4 Hours)**

Covers basic and advanced topics in imaging engineering. Starts with the formulation of typical forward problems in electromagnetic and acoustic wave field propagation and scattering, emphasizing biomedical and nondestructive testing applications, and continues with a survey of imaging methodologies including the so-called qualitative imaging methods. Topics covered are: obstacle scattering, inhomogeneous medium scattering, uniqueness and stability in inverse scattering, imaging with finite data, point-source method and its applications, singular sources and shape reconstruction, linear sampling methods, signal-subspace-based methods, noniterative approaches for the inverse medium problem, intensity-only imaging, estimation theory in imaging and the question of superresolution, and selected topics in compressive sensing and quantum imaging.

**Prerequisite(s):** EECE 7202 with a minimum grade of C-

**EECE 7296. Electronic Materials. (4 Hours)**

Offers a basic treatment of electronic materials from atomic, molecular, and application viewpoints. Topics include atomic structure and bonding in materials, structure of materials, and crystal defects. These topics lay a foundation for thermal and electronic conduction, which is the underlying physics of electronic devices. Examines the electronic properties of semiconductors, dielectric, magnetic, superconducting, and optical materials. The latter half of the course deals with an introduction to state-of-the-art electronic materials, including semiconductor nanoelectronics, magnetic semiconductors and Spintronics, molecular electronics, carbon nanotubes, conducting polymers, graphene and graphane, and other topics representing recent technological breakthroughs in the area of electronic materials.

**EECE 7310. Modern Signal Processing. (4 Hours)**

Covers theory and practice of modern signal processing techniques with emphasis on optimal filtering and multirate signal processing. Includes the principle of orthogonality, Wiener and Kalman filters, linear prediction, spectral factorization, the Yule-Walker equations, decimation and interpolation, Noble identities and polyphase representation, and maximally decimated filter banks.

**Prerequisite(s):** EECE 7204 with a minimum grade of C-

**EECE 7311. Two Dimensional Signal and Image Processing. (4 Hours)**

Examines the fundamentals of two-dimensional signal processing, with emphasis on image processing. Topics include signals, systems, and transforms in two dimensions; design and analysis of FIR and IIR filters; DFT and FFT algorithms; generation of digital image from the source; image digitizers and display devices; image transforms; techniques for point-wise, local, and global image enhancement; statistical image restoration techniques including recursive estimation; image coding techniques in spatial and transform domain including coding for facsimile transmission; and feature analysis. Requires a good understanding of linear systems, transform techniques, linear algebra, and random processes.

**EECE 7315. Digital Image Processing. (4 Hours)**

Focuses on generation of digital image from the source; image digitizers and display devices; image transforms; enhancement techniques, such as histogram, equalization, and edge sharpening; restoration by Wiener and Kalman filters; image coding using run-length coding; DPCM; transform coding; and feature analysis. Undergraduate course in digital signal processing highly recommended but not required.

**EECE 7323. Numerical Optimization Methods. (4 Hours)**

Introduces fundamental theoretical and algorithmic concepts behind numerical optimization theory for objective functions with finite numbers of parameters. Optimization problems arise ubiquitously in all areas of engineering and science. Presents established numerical methods for iterative unconstrained and constrained optimization. Topics covered include line-search and trust-region strategies, gradient descent and Newton methods and their variations, linear and quadratic programming, penalty-augmented Lagrangian methods, sequential quadratic programming, and interior point methods. The course relies on the use of Matlab in projects. Requires a basic knowledge of calculus and linear algebra.

**EECE 7324. Experimental Approach to Wireless Communications. (4 Hours)**

Examines the design, implementation, and testing of wireless communication solutions using modern RF technologies. Covers single- and multi-carrier modulations, synchronization, channel estimation and equalization, spread spectrum, multi-user interference, and coexistence. Explores practical applications in the deployment and advancement of wireless networks.

**Prerequisite(s):** EECE 5576 (may be taken concurrently) with a minimum grade of C-

**EECE 7336. Digital Communications. (4 Hours)**

Covers fundamentals of digital communications and coding and the basic structure of a communication system. Topics include modeling of information sources; entropy; rate distortion function; lossless and lossy source coding theorems; Huffman coding; Lempel-Ziv algorithm; scalar and vector quantization; digital modulation schemes and their spectral characterization including PAM, MPSK, QAM, OQPSK, MSK, pi/4-QPSK, CPFSK, CPM, and GMSK; and orthogonal, biorthogonal, and simplex signaling. Explores optimal receiver design and probability of error derivation for various systems. Covers noncoherent detection and DPSK systems and their performance. Discusses synchronization systems, analysis of PLL in the presence of noise, methods of timing recovery, channel capacity, and Shannon's noisy channel coding theorem. Studies cutoff rate and its communication system design. Other topics include coding systems, linear block codes, soft and hard decision decoding, performance of linear block codes, cyclic codes, convolutional codes, Viterbi decoding, error probability bounds, concatenated codes, MAP decoding, Trellis code modulation, communication over band-limited channels, ISI, Nyquist conditions, raised cosine signaling, partial response signaling, equalization techniques, linear adaptive equalization, decision feedback equalizers, maximum likelihood sequence detection, and communication over fading channels.

**Prerequisite(s):** EECE 7204 (may be taken concurrently) with a minimum grade of C- or EECE 3468 with a minimum grade of C-

**EECE 7337. Information Theory. (4 Hours)**

Discusses basic properties of entropy and mutual information, Shannon's fundamental theorems on data compression and data transmission in the single-user case, binning, and covering lemmas. Topics include rate distortion theory, feedback in one-way channels, Slepian-Wolf coding of correlated information sources, source coding with side information at the receiver, multiple access channel and its capacity region, and the capacity region of the Gaussian multiple access channel. Also covers broadcast channels, superposition coding, and the capacity region of the degraded broadcast channel; performance and comparison of TDMA, FDMA, and CDMA systems from a theoretical point of view; capacity issues for time-varying channels and channels with memory; relation between information theory and statistics; Stein's lemma; and large deviation theory.

**Prerequisite(s):** EECE 7204 with a minimum grade of C-

**EECE 7345. Big Data and Sparsity in Control, Machine Learning, and Optimization. (4 Hours)**

Covers the issue of handling large data sets and sparsity priors, presenting very recently developed techniques that exploit a deep connection to semi-algebraic geometry, rank minimization, and matrix completion. Focuses on applications, including control and filter design subject to information flow constraints, subspace clustering and classification on Riemannian manifolds, and activity recognition and classification and anomaly detection from video sequences. The goal of this course is to introduce the subject to people in the systems, machine-learning, and computer vision communities faced with "big data" and scaling problems and serve as a quick reference guide, summarizing the state of the art as of today and providing a comprehensive set of references.

**Prerequisite(s):** EECE 5644 with a minimum grade of C- or EECE 7323 with a minimum grade of C-

**EECE 7346. Probabilistic System Modeling and Analysis. (4 Hours)**

Covers fundamentals of probabilistic system modeling, building toward techniques that allow analyzing complex stochastic systems in a tractable fashion. Modeling large and complex systems requires reasoning about probabilistic behavior at a large scale. Reviews classic topics like Markov chains, convergence to a steady state, renewal processes, renewal reward processes, the strong law of large numbers, and the elementary renewal theorem. Additional topics include the asymptotic behavior of probabilistic systems, including stochastic approximation/Robbins-Monro type algorithms, and ODE/fluid limits. Illustrates how these modeling techniques can be applied in modeling real systems and adaptive algorithms, including queueing systems, distributed systems, and online learning algorithms like stochastic gradient descent.

**Prerequisite(s):** EECE 7204 with a minimum grade of C-

**EECE 7352. Computer Architecture. (4 Hours)**

Presents many of the issues involved in the design and analysis of new and evolving computer architectures. Topics include all aspects of the system including the microprocessor, memory, I/O, and networking. Emphasizes the connection between architecture and the underlying software that drives it. Topics include pipelining, superscalar, out-of-order execution and completion, data flow, caching, prefetching, virtual memory, RAID, and ATM switching. Performance analysis is another fundamental theme of this course. A project is assigned that involves the creation of a trace-driven simulation model to study the performance of various hardware or software architectural features. Also provides a survey of the current state of the art in processor architectures and provides additional readings from recent research in the field. Requires a working knowledge of C programming language.

**EECE 7353. VLSI Design. (4 Hours)**

Covers all aspects of VLSI design and engineering including VLSI design methodology; MOS transistors and circuits; CAD tools to create, extract, simulate, and evaluate physical layouts; CMOS fabrication process; evaluation and optimization of circuit area, power consumption, and propagation delay; CAD tools to design CMOS systems with standard cells; system clocking design and evaluation; the characteristics and limitations of CAD tools, such as simulation, placement, and routing; VLSI testing, fault models, test vector generation, and design for testability; design projects going through a complete VLSI design cycle; and a research project targeting a specific area of VLSI engineering. Requires a knowledge of electronics and digital systems design.

**EECE 7364. Mobile and Wireless Networking. (4 Hours)**

Analyzes the working principles and practice of current and future mobile and wireless networks. Topics include overviews of different wireless and mobile systems and applications, 5G and beyond cellular networks, current and upcoming Wi-Fi standards, and emerging networking architectures. Covers theoretical foundations to computer simulation-based exercises. Designed with a research component involving a project that allows students to match classroom concepts to real-world problems. The overall objective is to enable the student to critically evaluate current and future wireless and mobile systems through an awareness of communication and networking theory, software protocols, and architectural know-how.

**EECE 7368. High-Level Design of Hardware-Software Systems. (4 Hours)**

Presents state-of-the-art methods, tools, and techniques for system-level design and modeling of complete multiprocessor systems from specification down to implementation across hardware-software boundaries. Recognizes that system complexities are growing exponentially, driven by ever-increasing application demands and technological advances that allow one to put complete multiprocessor systems on a chip (MPSoCs). System-level design that jointly covers hardware and software is one approach to address the associated complexities in the design process and the market pressures. Using system-level design languages (e.g., SpecC, SystemC), offers students an opportunity to specify, simulate, analyze, model, and design hardware-software systems based on examples of typical embedded applications. Requires working knowledge of C/C++, algorithms, and data structures.

**Prerequisite(s):** EECE 7205 with a minimum grade of C-

**EECE 7370. Advanced Computer Vision. (4 Hours)**

Offers students an opportunity to obtain practical knowledge in computer vision and to develop skills for being a successful researcher in this field. The goal of the field of computer vision is to make useful decisions about real physical objects and scenes based on sensed images. Achieving this goal requires obtaining and using descriptions (models) of the sensors and the world. Computer vision is an exciting field that builds on very diverse disciplines such as image processing, statistics, pattern recognition, control theory and system identification, physics, geometry, computer graphics, and machine learning. Course material includes state-of-the-art in the field, current research trends, and algorithms and their applications, with an emphasis on the mathematical methods used.

**EECE 7374. Fundamentals of Computer Networks. (4 Hours)**

Presents an overview of modern communication networks using the internet as a primary case study. Uses the concept of layered network architecture as a framework for understanding the principal functions and services required for achieving reliable end-to-end communications. Topics include networking application design and network programming (socket programming), service interfaces and peer-to-peer protocols, the reference model for TCP/IP (internet), transport layer and network layer issues, data link layer and LANs (local area networks) architectures, and important emerging technologies, including software-defined networking (SDN). Covers the basics of wireless and mobile networking (principles and practice) and standardization and policy issues concerning communications and networks.

**EECE 7376. Operating Systems: Interface and Implementation. (4 Hours)**

Covers fundamentals of operating systems (OS) design, including theoretical, OS-generic design considerations as well as the practical, implementation-specific challenges in the development of a real OS. Requires proficiency in the C programming language, the GNU tool set for C programming, and debugging in Unix operating systems.

**Prerequisite(s):** CS 3000 with a minimum grade of C- or EECE 2560 with a minimum grade of C- or EECE 7205 with a minimum grade of C-

**EECE 7390. Computer Hardware Security. (4 Hours)**

Covers computer hardware and embedded system security and trust, a major concern for national security. Topics include crypto engineering, side-channel attacks, hardware security primitives, counterfeit electronics detection and prevention, logic locking and obfuscation, hardware Trojan detection and isolation, passive and active metering for the prevention of piracy, FPGA security, and artificial intelligence security from a hardware perspective. Reviews the foundations of the new and evolving area of hardware security and trust, as well as the state-of-the-art on trusted and assured microelectronics and system-on-chip design. Discusses current frontier papers to motivate research interests and ideas in building secure and trustworthy computer hardware systems.

**EECE 7393. Analysis and Design of Data Networks. (4 Hours)**

Introduces fundamental concepts and approaches for the analysis and design of data networks. Covers delay models, multi-access communication, scheduling, routing, congestion control, and network coding. Presents analytical techniques such as basic queuing theory, queuing networks, optimization, stochastic control, and distributed algorithms. Requires knowledge of basic probability.

**EECE 7397. Advanced Machine Learning. (4 Hours)**

Covers topics in advanced machine learning. Presents materials in the current machine learning literature. Focuses on graphical models, latent variable models, Bayesian inference, and nonparametric Bayesian methods. Seeks to prepare students to do research in machine learning. Expects students to read conference and journal articles, present these articles, and write an individual research paper. CS 7140 and EECE 7397 are cross-listed.

**Prerequisite(s):** CS 6140 with a minimum grade of C- or EECE 7204 with a minimum grade of C- or EECE 7313 with a minimum grade of C- or EECE 5644 with a minimum grade of C-

**EECE 7398. Advanced Special Topics in Electrical and Computer Engineering. (4 Hours)**

Covers topics of interest to the faculty member conducting this class for advanced study. May be repeated up to four times.

**EECE 7400. Advanced Special Problems in Electrical and Computer Engineering. (1-4 Hours)**

Offers advanced theoretical or experimental work under individual faculty supervision.

**EECE 7440. Electrical and Computer Engineering Leadership Challenge Project 1. (4 Hours)**

Offers students an opportunity to develop and present a plan for the demonstration of a marketable technology product or prototype with an electrical engineering focus. Constitutes the first half of a thesis-scale project in technology commercialization. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact, while enhancing the student's technological and engineering depth and fostering the student's leadership development.

**EECE 7442. Electrical and Computer Engineering Leadership Challenge Project 2. (4 Hours)**

Continues EECE 7440, a thesis-scale project in technology commercialization. Offers students an opportunity to demonstrate their development of a marketable technology product or prototype with an electrical engineering focus and to produce a written documentary report on the project to the satisfaction of an advising committee. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact, while enhancing the student's technological and engineering depth and fostering the student's leadership development.

**Prerequisite(s):** EECE 7440 with a minimum grade of C-

**EECE 7945. Master's Project. (4 Hours)**

Offers analytical and/or experimental work leading to a written report and a final short presentation by the end of the semester.

**EECE 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EECE 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**EECE 7990. Thesis. (4 Hours)**

Offers analytical and/or experimental work conducted under the auspices of the department.

**Prerequisite(s):** EECE 7945 with a minimum grade of C-

**EECE 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers analytical and/or experimental work conducted under the auspices of the department.

**EECE 8986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**EECE 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of program requirements for PhD candidacy.

**EECE 9986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision. May be repeated up to 4 times.

**EECE 9990. Dissertation Term 1. (0 Hours)**

Offers theoretical and/or experimental work conducted under the auspices of the department. Includes attendance at Distinguished Lecture Series (DLS).

**Prerequisite(s):** EECE 9000 with a minimum grade of S

**EECE 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** EECE 9990 with a minimum grade of S

**EECE 9996. Dissertation Continuation. (0 Hours)**

Offers continued dissertation work conducted under the supervision of a departmental faculty member. Includes attendance at Distinguished Lecture Series (DLS).

**Prerequisite(s):** EECE 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Electrical Engineering Technology - CPS (EET)

**EET 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EET 2005. Circuits AC/DC. (3 Hours)**

Covers the design and analysis of practical DC and AC circuits. DC-related topics include basic concepts; resistors; capacitors; inductors; series and parallel circuits; theorems of Norton and Thevenin; Ohm's law; Kirchhoff's laws; transient analysis of RL, RC, and RLC circuits; power and energy; power sources; and SPICE circuit simulation. AC topics include network theorems; phasors; sinusoidal sources; steady-state analysis; steady-state power; impedance; admittance and frequency response; resonance; Bode plots; average, reactive, and complex power; and SPICE circuits simulation.

**Prerequisite(s):** MTH 2100 with a minimum grade of D- or MTH 2120 with a minimum grade of D-

**Corequisite(s):** EET 2006

**EET 2006. Lab for EET 2005. (2 Hours)**

Accompanies EET 2005. Applies a range of topics from the course.

**Prerequisite(s):** MTH 2100 with a minimum grade of D- or MTH 2120 with a minimum grade of D-

**Corequisite(s):** EET 2005

**EET 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EET 3100. Electronics 1. (3 Hours)**

Covers the theory and practical uses of active semiconductors. Topics include the operating characteristics of diodes, field-effect transistors, bipolar junction transistors, MOS transistors, and op amps; the analysis and design of single-stage amplifiers, diode circuits, and transistor circuits; rectifier circuits, clamping and clipping circuits, voltage multipliers, Zener regulators, temperature measuring, discrete amplifiers, feedback, basic op amp circuits, and switching circuits. SPICE is used to simulate circuits.

**Prerequisite(s):** EET 2005 with a minimum grade of D-

**Corequisite(s):** EET 3101

**EET 3101. Lab for EET 3100. (2 Hours)**

Accompanies EET 3100. Covers topics from the course through various experiments.

**Prerequisite(s):** EET 2005 with a minimum grade of D- ; EET 2006 with a minimum grade of D-

**Corequisite(s):** EET 3100

**EET 3200. Electronics 2. (3 Hours)**

Covers advanced analog devices and circuits and their uses. Topics include operational amplifiers, power transistors, timers, linear voltage regulators, switching regulators, sensors, advanced op amp circuits, active filters, oscillator circuitry, function generator, comparators, and timer circuitry. SPICE is used to simulate circuits, and data sheet analysis is included.

**Prerequisite(s):** EET 3100 with a minimum grade of D- ; EET 3101 with a minimum grade of D-

**Corequisite(s):** EET 3201

**EET 3201. Lab for EET 3200. (2 Hours)**

Accompanies EET 3200. Covers topics from the course through various experiments.

**Prerequisite(s):** EET 3100 with a minimum grade of D- ; EET 3101 with a minimum grade of D-

**Corequisite(s):** EET 3200

**EET 3300. Digital Logic. (3 Hours)**

Covers the design, analysis, and simulation of digital circuits. Topics include number systems, Boolean algebra, logic gates, combinational logic, circuit simplification, multiplexers, demultiplexers, encoders, decoders, latches, flip-flops, registers, counters, synchronous sequential circuits, and read-only (ROM) and random-access memory (RAM). Includes digital logic circuitry based on RTL, TTL, ECL, and CMOS logic families and the simulation of digital circuits using a hardware description language.

**Prerequisite(s):** MTH 1100 with a minimum grade of D-

**EET 3750. Linear Systems. (3 Hours)**

Covers the basic theory of continuous and discrete systems, emphasizing linear time-invariant systems. Considers the representation of signals and systems in both the time and frequency domain. Topics include linearity, time invariance, causality, stability, convolution, system interconnection, sinusoidal response, and the Fourier and Laplace transforms for the discussion of frequency-domain applications. Analyzes sampling and quantization of continuous waveforms (A/D and D/A conversion), leading to the discussion of discrete-time FIR and IIR systems, recursive analysis, and realization. The Z-transform and the discrete-time Fourier transform are developed and applied to the analysis of discrete-time signals and systems.

**Prerequisite(s):** (EET 2005 with a minimum grade of D- ; EET 2006 with a minimum grade of D- ) or (EET 2100 with a minimum grade of D- ; EET 2101 with a minimum grade of D- ); MTH 3200 with a minimum grade of D-

**EET 3800. Control Systems. (3 Hours)**

Covers the analysis of feedback control systems under both transient and steady-state conditions. Topics include the application of Laplace transforms in the formulation of block diagrams and transfer functions in control systems modeling; the performance characteristics of feedback control systems; and the analysis of the stability of feedback control systems using Routh-Hurwitz criterion. Uses frequency plots and measurement techniques to evaluate steady-state responses.

**Prerequisite(s):** EET 3750 with a minimum grade of D-

**EET 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EET 4950. Seminar. (1-4 Hours)**

Offers an in-depth study of selected topics.

**EET 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**EET 4983. Topics. (1-4 Hours)**

Covers special topics in electrical engineering technology. May be repeated without limit.

**EET 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EET 4991. Research. (1-4 Hours)**

Offers students an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**EET 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic.

**EET 4994. Internship. (1-4 Hours)**

Provides students with an opportunity for internship work.

**Attribute(s):** NUpath Integration Experience

**EET 4995. Practicum. (1-4 Hours)**

Provides eligible students with an opportunity for practical experience.

**EET 4996. Experiential Education Directed Study. (1-4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major.

**Attribute(s):** NUpath Integration Experience

## Energy Systems (ENSY)

**ENSY 5000. Fundamentals of Energy System Integration. (4 Hours)**

Presents fundamental issues of successfully integrating and implementing energy systems. Exposes students to combined heat and power strategies (cogeneration system), strategies of incorporating renewable with nonrenewable energy sources, thermoeconomics, and carbon sequestration techniques. Includes energy, exergy, and thermoeconomic cost factors in the presented case studies. Explores the effects of public policy, regulations, and financial operations on selecting energy technology. Students are given case studies to illustrate the complexity of implementing energy systems and are expected to complete a major project involving proposing an energy system. Emphasizes that successful implementation of energy systems requires both a technical and an economic solution. Requires calculus-based physics and chemistry.

**ENSY 5050. Fundamentals of Thermal Science 1. (4 Hours)**

Introduces and reviews thermodynamic properties such as temperature, pressure, energy, enthalpy, and entropy. Defines work and heat interactions and calculates the amount of energy transferred during thermodynamic processes. Introduces the first and second laws of thermodynamics and concepts of thermodynamic equilibrium. Discusses mass, energy, and entropy balance relations as well as conversion devices, such as turbine, compressors, pumps, valves, and energy exchangers. Studies simple power plants, refrigeration, heat (energy) pumps, and stationary gas turbine systems. Presents and reviews fundamentals of calculus, such as limit, differentiation, integration, power series, vector spaces, and multivariable functions needed for thermodynamic analysis.

**ENSY 5060. Fundamentals of Thermal Science 2. (4 Hours)**

Studies fundamental principles in fluid mechanics and thermal systems analysis. Topics include hydrostatics (pressure distribution, forces on submerged surfaces, and buoyancy); Newton's law of viscosity; integral forms of basic laws (conservation of mass, momentum, and energy); pipe flow analysis; concept of boundary layer; and drag coefficient. Presents Navier-Stokes equations as differential forms of conservative properties. Introduces theories of thermal energy transport, including conduction, convection, and thermal radiation; the design of thermal systems; and fundamentals of calculus, such as linear algebra, vector fields, and curvilinear coordinate systems required for introducing concepts of fluid dynamics and heat transfer. Discusses surface and volume integrals, conservative vector fields, and surface flux. Green's, divergence, and Stokes theorems are introduced for vector and scalar fields.

**Prerequisite(s):** ENSY 5050 with a minimum grade of C- or ENSY 5050 with a minimum grade of C-

**ENSY 5100. Hydropower. (4 Hours)**

Covers fundamentals of hydropowered development projects and their relevant design parameters. Emphasizes harnessing the hydro-energy potentials of both natural and man-made reservoirs. Reviews hydro- and electromechanical equipment and civil structure. Addresses selection procedure and design parameters of the equipment and structure.

**ENSY 5200. Energy Storage Systems. (4 Hours)**

Explores the various energy storage technologies, their working, and their practical applications. Focuses on the state-of-the-art review of current and most recent technologies. Offers students an opportunity to explore various innovations in the field of energy storage that can be helpful for fulfilling our current energy storage needs. Covers many different energy storage systems such as mechanical, chemical, electrochemical, thermal, thermochemical, etc.

**ENSY 5300. Electrochemical Energy Storage. (4 Hours)**

Covers the basics of electrode kinetics and thermodynamics as applied to electrochemical energy storage systems, as well as batteries and capacitors for traction and stationary power. Discusses the chemical structure of electrodes and electrolytes and practical battery construction.

**ENSY 5400. Power Plant Design and Analysis. (4 Hours)**

Reviews the fundamental laws of thermodynamics and balance equations for mass, energy, exergy, and entropy. Studies thermochemistry, chemical equilibrium, fuels and combustion, steam power plant cycle, gas turbine systems, thermo-economics, nuclear power plants, and energy recovery.

**ENSY 5500. Smart Grid. (4 Hours)**

Covers fundamentals of smart electric power grid. Covers definition, design criteria, and technology. Smart grid can be defined as the application of information processing and communications to the power grid. Seeks to motivate development of the smart grid, evaluating options for adding sensing, communications, computation, intelligence, control, and automation to various parts of the electric system. Topics include automation, or lack thereof, in existing power systems; generation; transmission; distribution; and smart grid definition.

**ENSY 5585. Wind Energy Systems. (4 Hours)**

Introduces wind energy and its applications. Integrates aerodynamics of wind turbine design with the structures needed to support them. Covers types of wind turbines, their components, and related analyses; airfoil aerodynamics; concepts of lift, drag, pitching moment, circulation, angle of attack, and stall; laminar and turbulent boundary layers and separation concepts; fundamental conservation equations; Bernoulli's, Euler's, and Navier-Stokes equations and their applications; Betz limit; computational fluid dynamics and its application for flow over typical airfoils; compressibility and elements of one-dimensional gas dynamics; wind resource; wind climatology and meteorological data; turbine tower and structural engineering aspects of turbines; vibration problems; aeroelastic phenomena in turbines; small wind turbines and vertical axis wind turbines; and introduces environmental and societal impacts and economic aspects.

**ENSY 5600. Fundamentals of Solar Photovoltaic Energy Conversion. (4 Hours)**

Focuses on the principles and working fundamentals of photovoltaic (PV) energy conversion, while emphasizing currently available solar technologies. Studies the semiconductor processes and advanced characterization theories. Examines design, fabrication, characterization of the PV modules, and different generations of solar cells and their properties. Advanced topics include thin film cells, compound semiconductors multijunction, multiband cells, spectral conversion, and introduces organic devices. Offers insight about the energy consumption crisis, sustainable energy sources, PV system components, and solar markets. Also discusses issues relating to PV systems, economics, and sustainability.

**ENSY 5650. Geologic Energy Systems for Energy Generation and Carbon Sequestration. (4 Hours)**

Focuses on the technical fundamentals of geologic energy resources. Covers specific applications such as geothermal heat pumps, geothermal power generation, as well as geologic energy storage and carbon sequestration. Offers students an opportunity to use software to perform technical and economic assessments of such systems, reinforcing fundamental concepts. Geologic energy systems are deemed to be a major solution to the grand challenge of meeting rising global energy demand while also decarbonizing the economy.

**Prerequisite(s):** (ME 2380 with a minimum grade of D ; ME 3475 with a minimum grade of D ; ME 4570 with a minimum grade of D ) or graduate program admission

**ENSY 5700. Renewable Energy Development. (4 Hours)**

Examines a unique blend of technological and commercial aspects of renewable energy development focused on solar and storage projects with a strong focus on distributed projects. Topics include an introduction to the Independent System Operator New England and generation markets; site selection and layout development; tilt and orientation calculations; shading analysis and interrow spacing requirements; energy production modeling; solar string designs; DC/AC ratios; National Electrical Code requirements/compliances; and wind load analysis. Introduces battery energy storage system sizing analysis and requirements for behind-the-meter and front-of-meter projects, as well as renewable portfolio standards and carbon analysis. Offers an overview of financial modeling and basic tax equity structures. Discusses case studies requiring substantial class participation to uncover practical aspects of project development.

**ENSY 5800. Applications of Artificial Intelligence in Energy Systems. (4 Hours)**

Covers fundamentals of artificial intelligence (AI) used in engineering applications for energy systems. Introduces a brief treatment of AI methods. Examines several AI methods, including search algorithms, decision making under uncertainty, graphical methods, and machine learning. Discusses a more thorough treatment for how AI is used for engineering applications in energy systems. Application areas include power generation, electric grid, renewables, and energy storage. Focuses on practical considerations, including economic opportunity, verification and validation, risks, and nontechnical challenges.

**Prerequisite(s):** ENSY 5000 with a minimum grade of C-

**ENSY 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENSY 7440. Energy Systems Engineering Leadership Challenge Project 1. (4 Hours)**

Offers students an opportunity to develop and present a plan for the demonstration of a marketable technology product or prototype with an energy systems focus. Constitutes the first half of a thesis-scale project in technology commercialization. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological and engineering depth and fostering the student's leadership development.

**ENSY 7442. Energy Systems Engineering Leadership Challenge Project 2. (4 Hours)**

Continues ENSY 7440, a thesis-scale project in technology commercialization. Offers students an opportunity to demonstrate their development of a marketable technology product or prototype with an energy systems focus and to produce a written documentary report on the project to the satisfaction of an advising committee. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological and engineering depth and fostering the student's leadership development.

**Prerequisite(s):** ENSY 7440 with a minimum grade of C-

**ENSY 7945. Master's Project. (4 Hours)**

Offers theoretical or experimental work under individual faculty supervision.

**ENSY 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**ENSY 7990. Thesis. (4 Hours)**

Offers analytical and/or experimental work conducted under the direction of the faculty in fulfillment of the requirements for the degree.

**Prerequisite(s):** ENSY 7945 with a minimum grade of C-

## Engineering Cooperative Education (ENCP)

### **ENCP 2000. Introduction to Engineering Co-op Education. (1 Hour)**

Introduces engineering students to the cooperative education program and assists them through self-assessment in relation to the engineering profession. Offers students an opportunity to develop job search and career management skills and to learn about the co-op program. Analyzes how personality, values, skills, and interests relate to the co-op search and shape work experiences. Employer and student panels assist students exploring employment opportunities. Also introduces students to the attributes of a global engineer and the possibility of working globally.

**Prerequisite(s):** GE 1000 with a minimum grade of D- or ARCH 1000 with a minimum grade of D- or BIOL 1000 with a minimum grade of D- or BUSN 1102 with a minimum grade of D- or CHEM 1000 with a minimum grade of D- or CS 1200 with a minimum grade of D- or ENVR 1000 with a minimum grade of D- or FSEM 1000 with a minimum grade of D- or GENS 1102 with a minimum grade of D- or INPR 1000 with a minimum grade of D- or MATH 1000 with a minimum grade of D- or PHYS 1000 with a minimum grade of D-

### **ENCP 3000. Professional Issues in Engineering. (1 Hour)**

Provides students with an opportunity to reflect on both academic and co-op experiences in the context of planning for the senior year and beyond. Issues include professional and ethical issues, resolving ethical conflicts, awareness of engineers as professionals in a diverse world, strengthening decision-making skills, career portfolios, and lifelong learning needs, goals, and strategies. Students reflect upon issues of diversity from their experience in the University and in their cooperative education placements. Explores the role of different work and learning styles and diverse personal characteristics on the workplace and the classroom. Professional issues include impact of the cultural context, both in the United States and around the world, on the client, government relations, and the workplace.

**Prerequisite(s):** BIOE 2000 with a minimum grade of D- or CHME 2000 with a minimum grade of D- or CIVE 2000 with a minimum grade of D- or EECE 2000 with a minimum grade of D- or ENCP 2000 with a minimum grade of D- or MEIE 2000 with a minimum grade of D-

### **ENCP 6000. Career Management for Engineers. (1 Hour)**

Designed to introduce graduate engineering students to the cooperative education program and to maximize their learning by helping them become more intentional about learning in co-op and in the transfer of that knowledge and experience to and from their academic program and throughout their entire careers. Offers students an opportunity to develop career goals; to be able to identify and justify what they need to learn through their co-op experience and entire careers; and to acquire the tools to be able to continually assess what they already know, what they think they know, what they need to know, and what they would like to know in relation to achieving their career goals. Includes readings, exercises, and discussions. This course does not count toward degree requirements.

### **ENCP 6100. Introduction to Cooperative Education. (1 Hour)**

Introduces graduate students to the cooperative education program. Offers students an opportunity to develop job-search and career-management skills. Students perform discipline-specific assessments of their workplace skills, interests, and values and discuss how they impact personal career choices. Covers how to develop field/industry-specific materials, including a professional-style resumé and cover letter, and introduces students to career portfolios. Additional topics include ethics, professional behaviors, workplace culture, and proper interviewing techniques. Familiarizes students with workplace issues relative to their field of study while outlining co-op policies, procedures, and expectations of the cooperative education program and employers. This course does not count toward degree requirements.

### **ENCP 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

### **ENCP 6955. Co-op Work Experience Abroad - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

### **ENCP 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

### **ENCP 6965. Co-op Work Experience Abroad. (0 Hours)**

Offers eligible students an opportunity for work experience abroad. May be repeated without limit.

**ENCP 7100. Career Management for PhD Engineers. (1 Hour)**

Offers students an opportunity to develop job-search and career-management skills applicable to co-op, internship, and full-time positions. Students perform discipline-specific assessments of their workplace skills, interests, and values and discuss their impact on whether students want to pursue careers in academia or industry. Covers how to develop field/industry-specific materials, including a professional-style resumé, academic CV, LinkedIn profile, elevator pitch, and cover letter. Additional topics include networking; ethics; international student work authorization; workplace culture; interviewing techniques; and diversity, equity, and inclusion. Students complete a one-on-one mock interview with the instructor and hear from guest speakers with PhDs from industry or PhD students who have completed a co-op/internship experience.

**Engineering Interdisciplinary (ENGR)****ENGR 2963. Topics. (1,2 Hours)**

Offers undergraduate students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering. May be repeated three times.

**ENGR 4956. Community-Based Integration Experience. (4 Hours)**

Offers students an opportunity to engage in one or more projects or other structured experience in a community-based setting under faculty supervision and assessment.

**Attribute(s):** NUpath Integration Experience

**ENGR 4957. Student Activity-Based Integrated Experience. (4 Hours)**

Offers students an opportunity to engage in one or more projects or other structured aspect of a university-recognized student club or activity under faculty supervision and assessment.

**ENGR 5963. Topics. (1,2 Hours)**

Offers students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering. May be repeated up to three times.

**ENGR 5964. Projects for Professionals. (0 Hours)**

Offers students an applied project setting in which to apply their curricular learning. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review 'lessons learned,' and incorporate suggestions from this review to improve and further develop their career development and professional plan. May be repeated up to two times.

**ENGR 5965. Engaging with Industry Partners for Rising Professionals. (0 Hours)**

Offers students an enhanced applied project setting in which to apply their curricular learning. Working with a partner sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with the partner sponsor, and create a plan for implementing their recommendations. Curriculum supports students as they develop key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review lessons learned, and incorporate suggestions to improve and further hone their career development and professional plan. Career development opportunities through skill-building workshops, panels, and interview preparation are available. Partner-student interactions, including a culminating project presentation, allow partners to assess student potential for co-op, internship, or other employment opportunities with the partner. May be repeated up to two times.

**ENGR 6010. Fundamentals of the Platform Economy. (4 Hours)**

Provides an overview of the platform economy, focusing on the impact of digitalization across various industries and the emergence of new business models enabled by computing technologies. Covers the foundational aspects of computing that facilitate access to resources through platforms, the economic principles underpinning digital transformations, and the ethical considerations inherent in digital platform use. Examines the construction and implications of multi-sided platforms, including issues of bias and discrimination, and discusses regulatory frameworks aimed at addressing these challenges. Aims to provide a comprehensive understanding of the platform economy's dynamics, prepare students for interdisciplinary collaboration, and guide them in conceptualizing a digital platform business plan, with an emphasis on ethical and practical considerations.

**ENGR 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENGR 7976. Directed Study. (1-4 Hours)**

Offers theoretical or experimental work under individual faculty supervision. May be repeated seven times for a maximum of 8 total semester hours.

**ENGR 9700. Dissertation Fieldwork. (0 Hours)**

Offers students an opportunity to pursue experiential research outside the classroom and outside the university. Engineering PhD students only. May be repeated up to two times.

**ENGR 9701. Engineering Teaching Practicum. (0 Hours)**

Offers intermediate or terminal-level doctoral candidates a teaching assignment under the guidance of a faculty member. Typical activities include preparing and teaching recitations; preparing and teaching laboratory sessions; holding office hours; preparing and grading quizzes, problem sets, and other assignments; and assisting the instructor with other activities associated with teaching a course. All nonnative English speakers should conform to the university language requirements for teaching assistants. May be repeated up to five times.

**ENGR 9702. Dissertation Fieldwork - Half-Time. (0 Hours)**

Offers students an opportunity to pursue experiential research outside the classroom and outside the university. May be repeated up to eleven times.

## Engineering Leadership (ENLR)

**ENLR 3121. Engineering Leadership Professional Development. (0 Hours)**

Studies what leadership is; why it is so powerful; and how applying leadership knowledge, skills, and abilities increase marketability, job performance, potential, and career advancement. Offers students an opportunity to learn what attributes provide the confidence and ability to influence others in the workplace and beyond to achieve personal goals and desired outcomes. After completing the experiential interaction in a classroom setting, participants work through self-directed modules during co-op to increase responsibility and credibility and enhance the overall co-op experience. Upon completion of modules, participants present to Gordon Institute cadre on their experiences.

**ENLR 5121. Engineering Leadership 1. (2 Hours)**

Covers elements of engineering practices such as product engineering (system design and engineering, integration, and documentation); engineering leadership (team building, communication, leadership styles, ethical behavior, and conflict resolution); market assessment (engineering economics, business plans, intellectual property, risk assessment, and mitigation); and engineering excellence (quality, reliability, serviceability, manufacturability, procurement, and problem solving). Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological and engineering depth and fostering the student's leadership development.

**ENLR 5122. Engineering Leadership 2. (2 Hours)**

Continues the examination of engineering practices begun in ENLR 5121. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological and engineering depth and fostering the student's leadership development.

**Prerequisite(s):** ENLR 5121 with a minimum grade of C- or ENLR 5121 with a minimum grade of D-

**ENLR 5131. Scientific Foundations of Engineering 1. (2 Hours)**

Presents the fundamental science underlying engineering disciplines. Develops a conceptual framework to understand interdisciplinary engineering practice and to make informed, back-of-the-envelope, quantitative estimates. Covers topics such as principles of mechanics and mechanics of materials, wave physics, quantum physics, statistical and thermal physics, fluid physics, Maxwell's equations and constitutive relations, and topics in chemistry and biology.

**ENLR 5132. Scientific Foundations of Engineering 2. (2 Hours)**

Continues the examination of fundamental science begun in ENLR 5131.

**Prerequisite(s):** ENLR 5131 with a minimum grade of C- or ENLR 5131 with a minimum grade of D-

**ENLR 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENLR 7440. Engineering Leadership Challenge Project 1. (4 Hours)**

Offers students an opportunity to develop and present a plan for the demonstration of a marketable technology product or prototype. This course is the first half of a thesis-scale project in technology commercialization. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological and engineering depth and fostering the student's leadership development.

**ENLR 7442. Engineering Leadership Challenge Project 2. (4 Hours)**

Continues ENLR 7440, a thesis-scale project in technology commercialization. Offers students an opportunity to demonstrate their development of a marketable technology product or prototype and produce a written documentary report on the project to the satisfaction of an advising committee. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological and engineering depth and fostering the student's leadership development.

**Prerequisite(s):** ENLR 7440 with a minimum grade of C-

**ENLR 7444. Engineering Leadership Challenge Project Continuation. (0 Hours)**

Continues ENLR 7442, a thesis-scale project in technology commercialization. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological and engineering depth and fostering the student's leadership development.

## Engineering Management (EMGT)

**EMGT 5220. Engineering Project Management. (4 Hours)**

Examines the theory and practice of managing projects. Explores human, mathematical, entrepreneurial, managerial, and engineering aspects of project management. The systems development life cycle is the framework for the course. Addresses needs analysis, requirements definition, design, and implementation in the context of project management. Introduces mathematical and software tools for planning, monitoring, and controlling projects.

**EMGT 5300. Engineering/Organizational Psychology. (4 Hours)**

Offers an analysis of the purpose and functioning of organizations as the basic networks for achieving goals through coordination of effort, communication, and responsibility. Studies the role and function of engineering organizations based on modern behavioral science concepts as well as the application of psychology to industry relative to human relations, group dynamics, tests and measurements, personnel practices, training, and motivation. Examines the evolution of the learning organization and its role in the management of R&D and technology, the influence of the rapid changes in technology, and the globalization of the marketplace through group-oriented case studies.

**EMGT 6225. Economic Decision Making. (4 Hours)**

Explores economic modeling and analysis techniques for selecting alternatives from potential solutions to an engineering problem. Considers measures of merit, such as present worth, annual worth, rate of return, and benefit/cost techniques. Examines recent techniques of economic analysis, especially the tools of decision making. Explores decisions under uncertainty. Studies the causes of risk and uncertainty, and examines ways to change and influence the degree of risk and uncertainty through sensitivity analysis, expectation-variance criterion, decision tree analysis, statistical decision techniques, and multiple attribute decision making through group case studies.

**EMGT 6305. Financial Management for Engineers. (4 Hours)**

Examines the issues and processes of short-term financing on industrial firms, financial analysis of cases, supplemented by readings to develop familiarity with sources and uses of working capital as well as the goals and problems involved in its management. Also covers the analysis necessary for such long-term financial decisions as issuance of stock or bonds; contracting of leases or loans, and financing of a new enterprise; mergers, capital budgeting, the cost of capital, and the valuation of a business. Examines financial statement ratio analysis along with the use of the capital asset pricing model as it relates to risk and return. Explores leverage and capital structure and international managerial finance in the examination of the overall financial policy decision-making process.

**EMGT 6600. Engineering Team Performance. (4 Hours)**

Offers students an opportunity to obtain foundational knowledge of team performance and learn the practical application of principles to enable them to develop practical skills in managing engineering and other technical team development initiatives. Teaming is a critical technique used to make a positive impact on personal and organizational performance and is essential for engineering and other technical disciplines. Designed to help students understand why and how team skills are critical to organizational success, learn how to use team skills to more effectively achieve engineering and technical goals as well as to organize and influence others to work more effectively, and to apply cognition to develop higher-performing teams.

**EMGT 6700. Digital Product Design and Management. (4 Hours)**

Examines the theory and practice of digital product design and management, tailored for engineering students. The development of quality digital products is of critical importance yet companies are still delivering products that take too long to manufacture, cost too much, and are not wanted by customers. Explores human, entrepreneurial, managerial, and engineering aspects of product management using a "learning-by-doing" approach to build product management skills. Designed for engineering students without product management experience but an interest in this area of study.

**EMGT 6750. Advanced Product Management. (4 Hours)**

Studies how basic product management concepts are applied in practice. Building the "right" product is an art and requires a specific approach, which we call product mindset, and behind every successful product is a team that internalizes this mindset. At the heart of this team is a product manager who understands the user's needs and knows how to effectively collaborate with stakeholders. Analyzes product mindset and the tools and skills that make a successful product manager. Focuses on practical examples from the industry and learning from our guest lecturers and instructor experience about how product management is being done in real life.

**EMGT 6760. Technical Product Management. (1 Hour)**

Explores product management for software products through practical, real-world applications. Focuses on key skills such as problem definition, human-centered design, product iteration, and user testing. Offers students opportunities to apply these techniques to real product scenarios while incorporating feedback from industry professionals.

**EMGT 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EMGT 7374. Special Topics in Engineering Management. (4 Hours)**

Offers topics of interest to the staff member conducting this class for advanced study. May be repeated without limit.

**EMGT 7945. Master's Project. (4 Hours)**

Offers theoretical or experimental work under individual faculty supervision.

**EMGT 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EMGT 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated up to seven times for a maximum of 8 semester hours.

**EMGT 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**EMGT 7990. Thesis. (4 Hours)**

Offers analytical and/or experimental work conducted under the direction of the faculty in fulfillment of the requirements for the degree. Requires first-year students to attend a graduate seminar program that introduces the students to the methods of choosing a research topic, conducting research, and preparing a thesis. Requires successful completion of the seminar program.

**Prerequisite(s):** EMTG 7945 with a minimum grade of C-

**EMGT 7996. Thesis Continuation - Half-Time. (0 Hours)**

Continues thesis work conducted under the supervision of a departmental faculty member.

## English (ENGL)

**ENGL 1000. English at Northeastern. (1 Hour)**

Intended for first-year students in the College of Social Sciences and Humanities. Introduces first-year students to the liberal arts in general; familiarizes them with their major; helps them develop the academic skills necessary to succeed (analytical ability and critical thinking); provides grounding in the culture and values of the University community; and helps them develop interpersonal skills—in short, familiarizes students with all skills needed to become a successful university student.

**ENGL 1140. Grammar: The Architecture of English. (4 Hours)**

Provides students with the basic tools for analyzing how sentences work. Whenever we produce or understand a sentence, we are following unconscious rules of grammar, our internalized “architecture” of English. In this course, we learn a new method for discovering and describing sentence structure and as well as a useful set of tools for analyzing language in all of its representations.

**Prerequisite(s):** ENGL 1102 (may be taken concurrently) with a minimum grade of C or ENGL 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Formal/Quant Reasoning

**ENGL 1160. Introduction to Rhetoric. (4 Hours)**

Introduces major concepts, traditions, and issues in rhetorical studies. Explores topics such as the range of ways that people persuade others to change their minds or take action; the relationship among language, truth, knowledge, and power; the role of language in shaping identity, communities, and cultures; and the use of rhetoric for activism and advocacy. Focuses on rhetoricians and rhetorics from diverse traditions, emphasizing contemporary and interdisciplinary approaches to investigating a wide range of rhetorical artifacts.

**Prerequisite(s):** ENGL 1102 (may be taken concurrently) with a minimum grade of C or ENGL 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**ENGL 1300. Introduction to Health and Humanities. (4 Hours)**

Explores the ways in which narrative and other forms of creative and cultural expression help shape conceptions of illness, healing, and the body. Offers students opportunities to consider the health and humanities through a variety of interdisciplinary perspectives and genres. Includes small-group and classwide experiential field outings. Culminates in the composition of reflective responses, a medical ethics/medical journalism piece, and a team-based experiential e-portfolio project. Course objectives include differentiating between healing and curing; knowing how to elicit, listen to, and analyze stories to determine how participants in the healthcare system experience illness and healing; being able to articulate the ways health is a cultural construct; and using this analysis to identify an empathic response as a future professional.

**Attribute(s):** NUpath Interpreting Culture

**ENGL 1400. Introduction to Literary Studies. (4 Hours)**

Introduces the diverse fields that comprise literary studies for English majors and minors. Surveys the methods and topics of English literary and textual studies, including a wide range of media (e.g., images, film, and graphic narrative). Explores strategies for reading, interpreting, and theorizing about texts, including how race, gender, sexuality, class, and colonialism are represented in literary texts, other media, and scholarship. Focuses on developing skills in thinking analytically, writing clearly about complex ideas, and conducting research.

**Prerequisite(s):** ENGL 1102 (may be taken concurrently) with a minimum grade of C or ENGL 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**ENGL 1410. Introduction to Research on Writing. (4 Hours)**

Introduces students to research about the histories, theories, and practices informing how people learn to write and how writing is used in home, school, work, and civic contexts. Explores writing and writing instruction in the United States and in international contexts, including the social and political significance of writing in particular cultural contexts with an emphasis on diversity, equity, and inclusion. Class projects emphasize methods such as archival research, case study research, multimodal composing, and community-based writing that invite students to think about their own experiences and practices of other groups.

**Prerequisite(s):** ENGL 1102 (may be taken concurrently) with a minimum grade of C or ENGL 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**ENGL 1450. Reading and Writing in the Digital Age. (4 Hours)**

Grapples with the long and sometimes tumultuous relationship between texts and new media technologies. Offers students opportunities to historicize and engage the social and intellectual upheavals of our own technological moment through reading, discussion, writing projects, and practicums that seek to develop skills for analyzing the data and metadata of texts through both qualitative and quantitative methods.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Interpreting Culture, NUpath Writing Intensive

**ENGL 1502. American Literature to 1865. (4 Hours)**

Surveys the major American writers and major literary forms from the colonial period to the Civil War. Includes works by such writers as Bradstreet, Taylor, Wheatley, Cooper, Poe, Hawthorne, Douglass, Stowe, Melville, and Emerson.

**Prerequisite(s):** ENGL 1102 (may be taken concurrently) with a minimum grade of C or ENGL 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**ENGL 1600. Introduction to Shakespeare. (4 Hours)**

Introduces students to a selection of Shakespeare's major plays in each of the principle genres of comedy, tragedy, history, and romance.

**Prerequisite(s):** ENGL 1102 (may be taken concurrently) with a minimum grade of C or ENGL 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**ENGL 1700. Global Literatures 1. (4 Hours)**

Introduces students to global works from the earliest literatures to 1500. May include texts from Africa (*Sunjara*); the Americas; Asia (Murasaki Shikibu's *Tale of Genji* from Japan and Lao Tzu's *Tao Te Ching* from China); Europe (Dante Alighieri's *Divine Comedy* from Italy, the *Song of Roland* from France, Homer's *Iliad* from Greece); and the Middle East (*The Epic of Gilgamesh* from Mesopotamia and *One Thousand and One Nights* from Arabic, Indian, and Persian sources). Works in translation where necessary.

**Prerequisite(s):** ENGL 1102 (may be taken concurrently) with a minimum grade of C or ENGL 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ENGL 1701. Global Literatures 2. (4 Hours)**

Introduces students to selected global literary works from the 16th century to the present. May include works from Africa (A. Igoni Barrett's *Blackass* from Nigeria); the Americas (Leslie Marmon Silko's *Ceremony* from the Laguna people, *Popol Vuh* from the Mayan peoples, and Isabel Allende's *The House of the Spirits* from Chile); Asia (Anita Desai, *Clear Light of Day* from India and Kyung-sook Shin's *Please Look After Mom* from South Korea); Europe (Evliya Çelebi's *Book of Travels: The City of Boudonitz* from Turkey, Miguel de Cervantes' *Don Quixote* from Spain, and François Rabelais' *Gargantua and Pantagruel* from France). Works in translation where necessary.

**Prerequisite(s):** ENGL 1102 (may be taken concurrently) with a minimum grade of C or ENGL 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ENGL 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENGL 2296. Early African-American Literature. (4 Hours)**

Surveys the development and range of black American writers, emphasizing poetry and prose from early colonial times to the Civil War. ENGL 2296 and AFM 2296 are cross-listed.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ENGL 2301. The Graphic Novel. (4 Hours)**

Explores the word-and-image medium of comics as a narrative form. Focuses on the contemporary phenomenon of the so-called graphic novel. Covers the preoccupations of today's graphic novels and how their storytelling works. Includes some work in translation, but the course largely concentrates on the American tradition, focusing on fiction, memoir, and nonfiction reporting and adaptation. Offers students an opportunity to learn practices of reading—and making—comics. Emphasizes the formal language, or grammar, of the comics genre in order to interpret its narrative procedure and possibilities.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**ENGL 2302. Culture, Technology, and the Future of Health. (4 Hours)**

Introduces the challenges posed by the data-heavy medicine of the future to privacy, the appropriate collection of medical data, and the ways that patients and healthcare workers alike think about health. Offers students an opportunity to learn how to use critical and ethical theories, analyze health narratives, and use historical and contemporary data about health disparities to forecast how new technologies might pose social and cultural challenges. Takes a humanities perspective to critically evaluate social and cultural aspects of a healthcare system shaped by emerging technologies and the data they produce.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**ENGL 2330. The American Renaissance. (4 Hours)**

Studies the nineteenth-century development of an American national literary tradition in the context of democratic and romantic attitudes toward experience, nation formation, and national crisis. Includes such writers as Emerson, Thoreau, Hawthorne, Fuller, and Melville.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ENGL 2420. Contemporary Poetry. (4 Hours)**

Studies developments in British and (especially) American poetry since 1945. Includes such writers as Bishop, Lowell, Ginsberg, Ashbery, Walcott, Heaney, Kunitz, Jorie Graham, Frank Bidart, Rita Dove, and Kevin Young.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGL 2430. Contemporary Fiction. (4 Hours)**

Examines British and American writers from 1945 to the present, including such figures as Lessing, Burgess, Pynchon, Morrison, Kingston, and Erdrich.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGL 2440. The Modern Bestseller. (4 Hours)**

Focuses on contemporary commercially successful fiction and nonfiction, including memoir, dystopian, fantasy, young adult, and experimental works. Examines the historical, cultural, and political contexts in which bestsellers were written and how they are named "bestsellers." Taking race, gender, class, and other identity markers into consideration, explores how some writers and audiences are included or excluded from the most popular bestseller lists.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture

**ENGL 2450. Postcolonial Literature. (4 Hours)**

Examines the literature and cultures of postcolonial nations in the Caribbean, Africa, and Asia. Designed to familiarize students with the cultural paradigms and transnational experiences of colonialism. Introduces various theories about postcolonialism and decolonization. Focuses on the variety of artistic strategies employed by writers to communicate contemporary postcolonial themes such as neocolonialism, nationalism, global feminisms, and diaspora.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ENGL 2451. Postcolonial Women Writers. (4 Hours)**

Examines the literature and cultures of postcolonial nations in the Caribbean, Africa, Asia, and elsewhere through the lens of gender. Designed to familiarize students with the relationships between cultural paradigms associated with gender and transnational experiences of colonialism. Focuses on the variety of artistic strategies employed by writers to communicate the impacts of gender and sexuality on contemporary postcolonial themes such as neocolonialism, nationalism, and diaspora. Writers may include Chimamanda Adichie, Nawal El Saadawi, Marjane Satrapi, Bessie Head, Arundhati Roy, Banana Yoshimoto, Sonia Singh, and Dionne Brand.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ENGL 2455. American Women Writers. (4 Hours)**

Surveys the diversity of American women's writing to ask what it means to describe writers as disparate as Phillis Wheatley, Edith Wharton, Toni Morrison, and Alison Bechdel as part of the same 'tradition.' With attention to all genres of American women's writing, introduces issues of race, genre and gender; literary identification; canons; the politics of recuperation; silence and masquerade; gender and sexuality; intersectionality; sexual and literary politics, compulsory heterosexuality, and more.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ENGL 2460. Multiethnic Literatures of the U.S.. (4 Hours)**

Explores contemporary American literature by writers from distinctive ethnic groups (for example, Native, Asian, African, Latino/a, Jewish, Italian, Irish, Arab). Features a variety of works that reflect an evolving recognition of the artistically and culturally diverse nature of American literature.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ENGL 2470. Asian-American Literature. (4 Hours)**

Introduces students to American writers of Chinese, Japanese, Korean, Filipino, South Asian, and Southeast Asian descent. Focuses on works published since the 1960s. Pays close attention to prevalent themes, sociohistorical contexts, and literary form.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ENGL 2490. Native American Literature. (4 Hours)**

Studies literature by Native American authors in the United States. Examines debates in critical Indigenous studies, focusing on the literary forms and Indigenous methods deployed by poets and writers to examine tribal sovereignty, settler colonialism, and the histories and presence of anticolonial movements. Emphasizes the ways contemporary American Indian writers use traditional and contemporary forms to express and affirm tribal language, memory, community, and knowledge while forging literary resistance to ongoing effects of settler colonialism.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ENGL 2520. Science Fiction. (4 Hours)**

Traces the development of various science fiction themes, conventions, and approaches (human vs. machine, human/machine hybrids, alien encounters, colonizing other worlds, dystopian and postapocalyptic futures). Examines how science fiction explores what it means to be human and how self- and group identities are formed when measured against the idea of the non- or other-than-human.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture

**ENGL 2570. Latinx Literature. (4 Hours)**

Explores Latinx literary voices alongside primary source materials to account for the rich, multilingual, multiethnic, multigenre writing tradition that shapes Latinx American literature. Examines texts from autobiographies, novels, short stories, poems, plays, and performance art to engage the histories and presence of Indigenous communities, the politics of migration and exile, and the ongoing dynamics of colonization.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity

**ENGL 2600. Irish Literary Culture (Abroad). (4 Hours)**

Explores Irish writers from the nineteenth century through the present. Emphasizes their relationships to contemporary Irish society. Explores the formal traditions of Irish writing as well as the historical, political, and cultural discourses that Irish writing has both helped to shape and within which the writing circulates. As the course takes place in Dublin during the summer term, offers students an opportunity to meet living Irish writers who talk about their relationship to the literary tradition and their own craft. Covers writers such as Oscar Wilde, James Joyce, Kate O'Brien, Colm Tóibín, Anne Enright, Paul Murray, Kevin Barry, and Maeve Binchy.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C

**Attribute(s):** NUpath Integration Experience, NUpath Interpreting Culture

**ENGL 2620. What Is Nature?. (4 Hours)**

Focuses on a variety of texts (imaginative literature, memoir, scientific writing, creative nonfiction, and popular journalism) that take nature, ecology, and the environment as their subject. Examines paintings, photography, and other visual representations (such as computer simulations) of the natural world. Taught in Boston or in the United Kingdom.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Integration Experience, NUpath Interpreting Culture

**ENGL 2650. Science Writing: Origins, Ethics, and Emerging Genres. (4 Hours)**

Explores the history, development, and roles of academic and popular science writing, beginning with a critical examination of the origins of scientific genres. Students describe, define, and contextualize science writing genres. Reviews the ethical foundations and problems of current scientific genres. Offers students an opportunity to participate in the global dissemination of scientific knowledge and knowledge creation through a variety of writing assignments.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**ENGL 2695. Travel and Place-Based Writing. (4 Hours)**

Focuses on travel writing and place-based writing. Examines the history, global cultural contexts, conventions of, and theories about the genres through reading exemplary texts and studying photographs and films. Offers students an opportunity to produce examples of travel writing and place-based writing as well as short videos and photo-collages.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**ENGL 2700. Creative Writing. (4 Hours)**

Gives the developing writer an opportunity to practice writing various forms of both poetry and prose. Features in-class discussion of student work.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**ENGL 2710. Style and Editing. (4 Hours)**

Explores the relationship between style and substance through close attention to choices made at the level of the paragraph, sentence, and word. Introduces editorial processes and practices and gives students practice in editing for themselves and others.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Writing Intensive

**ENGL 2730. Digital Writing. (4 Hours)**

Explores the ways in which composing processes and meaning are impacted when writing moves from material media (e.g., print, images, voice, and performance) to digital media (e.g., hypertexts, digital stories, and videos). Readings cover aspects of digital writing as semiotic (e.g., domains of meaning, mode, materiality, delivery, ensembles of meaning) and draw on theories of multimodality to explore digital remediations of writing. Culminates in an electronic portfolio and collective exhibit.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Writing Intensive

**ENGL 2760. Writing in Global Contexts. (4 Hours)**

Explores the various ways that linguistic diversity shapes our everyday, academic, and professional lives. Offers students an opportunity to learn about language policy, the changing place of World English in globalization, and what contemporary theories of linguistic diversity, such as translingualism, mean for writing. Invites students to explore their own multilingual communities or histories through empirical or archival research.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture, NUpath Writing Intensive

**ENGL 2770. Writing to Heal. (4 Hours)**

Explores how creative writing can be used as a healing tool. Offers students opportunities to analyze, theorize, and create healing narratives through readings, in-class writing activities, writing workshops, and process journals. Culminates in the creation and revision of written personal narratives as well as a digital storytelling project.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Writing Intensive

**ENGL 2780. Visual Writing. (4 Hours)**

Explores how visual elements, such as fonts, graphics, charts, and video, work within different types of documents to reach various audiences across cultures. Readings cover several aspects of visual writing (e.g., thinking, learning, and expressing) and draw on theories of visual rhetoric to explore the interaction among content, visual elements, audiences, and contexts. Culminates in an electronic portfolio and collective exhibit.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture, NUpath Writing Intensive

**ENGL 2850. Writing for Social Media: Theory and Practice. (4 Hours)**

Explores the development and roles of social media writing. Asks students to describe, define, and contextualize current social media genre(s) using readings from social media sites, scholarship, popular/journalistic works, and fiction. Invites students to adopt a new social media platform and to produce social media writing in short, longer individually produced, and longer collaborative forms. Offers each student an opportunity to create a curated, reflective portfolio that works toward an integrated personal/professional digital identity.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture, NUpath Writing Intensive

**ENGL 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENGL 2991. Research Practicum. (2-4 Hours)**

Involves students in collaborative research under the supervision of a faculty member. Offers students an opportunity to learn basic research methods in the discipline. Requires permission of instructor for freshmen. May be repeated once for up to 4 total credits.

**ENGL 2995. Practicum. (1-4 Hours)**

Offers eligible students an opportunity for practical experience. May be repeated without limit.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGL 3070. Literary Genres. (4 Hours)**

Explores the characteristics of a particular literary form over time or in a given time frame through works by various authors. Emphasizes historical and cultural contexts.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGL 3101. Early Literatures. (4 Hours)**

Focuses on a particular theme, author, genre (such as epic or romance), or other aspect of premodern literatures (such as representations of gender and sexuality and/or race). Selected texts may include classical literary works or literatures of the Middle Ages and/or the Early Modern period.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture

**ENGL 3120. 17th- and 18th-Century Literatures. (4 Hours)**

Focuses on a particular topic in 17th- or 18th-century British or American literature, such as women and the novel or the captivity narrative.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGL 3160. Topics in 17th- and 18th-Century British Literatures. (4 Hours)**

Focuses on a particular aspect of seventeenth- or eighteenth-century British literature, such as representations of the new science in the seventeenth century or the rise of the novel in the eighteenth century. May be repeated twice.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture

**ENGL 3161. 20th- and 21st-Century Literatures. (4 Hours)**

Focuses on a particular topic, theme, author, or genre in 20th- or 21st-century British and/or American literature. Emphasizes historical and cultural contexts.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGL 3190. Topics in 19th-Century American Literature. (4 Hours)**

Focuses on a group of authors (e.g., the Fireside Poets, Transcendentalists, regional/local color writers); specific theme (e.g., Manifest Destiny, American romanticism, regionalism, sentimentalism, slavery, democracy, public vs. private); or genre (e.g., the slave narrative, the novel, lyric poetry) in nineteenth-century American literature. May be repeated without limit.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGL 3325. Rhetoric of Law. (4 Hours)**

Introduces students to the persuasive work of legal texts, procedures, and institutions. Investigates the range of critical approaches to the study of law and rhetoric, as well as the implications of understanding law as rhetorical. Draws on texts produced by lawyers and judges, classical rhetoricians, contemporary rhetorical critics, and legal scholars.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture

**ENGL 3340. Technologies of Text. (4 Hours)**

Examines innovations that have reshaped how humans share information, e.g., the alphabet, the book, the printing press, the postal system, the computer. Focuses on debates over privacy, memory, intellectual property, and textual authority that have historically accompanied the rise of new media forms and genres. Offers students an opportunity to gain skills for working with texts using the rapidly changing tools of the present, e.g., geographic information systems, data mining, textual analysis.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Creative Express/Innov, NUpath Integration Experience

**ENGL 3370. Writing Cultures. (4 Hours)**

Offers students an opportunity to conduct qualitative empirical research (using methods such as interviewing and observation) into rhetorical practices, such as reading, writing, listening, speaking, and body language. Explores the role of rhetoric and writing in the representation of people, cultures, and research in online and physical spaces.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Integration Experience, NUpath Interpreting Culture, NUpath Writing Intensive

**ENGL 3374. Writing London. (4 Hours)**

Explores how writing shapes the life of, and life in, the city. Considers how London is constructed in a range of discourses and disciplines. Offers students an opportunity to research and write about the city and participate in a community-based writing project.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Integration Experience, NUpath Interpreting Culture, NUpath Writing Intensive

**ENGL 3375. Writing Boston. (4 Hours)**

Explores how writing shapes the life of, and life in, the city. Considers how Boston is constructed in a range of discourses and disciplines. Offers students an opportunity to research and write about the city and participate in a community-based writing project.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Integration Experience, NUpath Interpreting Culture, NUpath Writing Intensive

**ENGL 3376. Creative Nonfiction. (4 Hours)**

Explores how writers apply narrative strategies and techniques to factual material. Offers students an opportunity to read and write a variety of nonfiction forms (e.g., narrative essays and narrative journalism, travel and science writing, memoir, editorials, protest and political essays), as well as cross-genre and hybrid forms (e.g., nonfiction prose mixed with poetry, audio and graphic nonfiction). The topics for narrative nonfiction writing apply to a wide array of disciplines, including the humanities, the sciences, and journalism.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Writing Intensive

**ENGL 3377. Poetry Workshop. (4 Hours)**

Offers an advanced workshop in writing and reading original poetry. Students experiment in established poetic forms. Features in-class discussion of student work.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**ENGL 3378. Fiction Workshop. (4 Hours)**

Offers an advanced workshop in writing and reading original fiction. Features in-class discussion of student work.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**ENGL 3380. Writing Seminar. (4 Hours)**

Offers writers an opportunity to hone their skills in a workshop focused on a particular topic or form, such as advocacy writing, public policy writing, autobiography and memoir, rhetoric for writers, speculative fiction, or screenwriting.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Writing Intensive

**ENGL 3381. The Practice and Theory of Teaching Writing. (4 Hours)**

Focuses on the teaching of writing by studying the professional literature of writing theory as well as a teaching practicum. Students work as a writing tutor or shadow experienced teachers. Offers students an opportunity to prepare for future teaching of writing and to obtain deeper insight into their own writing processes.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Integration Experience, NUpath Writing Intensive

**ENGL 3382. Publishing in the 21st Century. (4 Hours)**

Explores modes and processes of publication in an era of technological and economic change. Investigates the roles of writers, editors, and publishers in this shifting landscape. Offers students an opportunity to attend readings, lectures, and other community literacy events and work with community partners on publication projects.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Integration Experience, NUpath Writing Intensive

**ENGL 3400. Opening the Archive. (4 Hours)**

Introduces students to the rich archival holdings in the greater Boston area, as well as to online archives. Offers students an opportunity to obtain training in the materials and methods of primary source research. Primary materials include a wide range of resources, including books, manuscripts, letters, pamphlets, broadsides, journals, maps, illustrations, and photographs. May focus on Shakespeare's archive, archives for social justice, literary uses of archives, queer archives, people of color in the archive, or other themes.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Integration Experience, NUpath Interpreting Culture, NUpath Writing Intensive

**ENGL 3404. African American Rhetorical Traditions. (4 Hours)**

Examines and organizes the ways that African Americans have historically maintained their humanity and negotiated freedom through discourse. Explores various discursive practices of African American discourse communities—such as the enslaved, abolitionists, feminists, nationalist/revolutionaries, and entertainers—to engage discussions about freedom, access to democracy, racial uplift, gender equity, and the discursive and recursive nature of racial identity. Studies historical contexts and current sociopolitical dynamics emphasizing the Black Jeremiad, civil rights rhetoric, the Black Power Movement, Black Feminist Thought, and Hip-Hop.

**Prerequisite(s):** ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ENGL 3458. Language Matters. (4 Hours)**

Explores language "on the ground," drawing from a range of topics where language matters— legal language, political discourse, grammar teaching, standard and "nonstandard" dialects, language controversies, and how the rules of grammar and usage are changing, among others.

**ENGL 3460. The Archives of Public Health. (4 Hours)**

Presents the history of public health through firsthand experience working with archival materials. Emphasizes the stories told about public health crises in the past: how individuals experienced crisis; how communities encountered, managed, and responded to the crisis; and what stories public health institutions produced to narrate their own efforts and shape individual behaviors. Offers students an opportunity to gain experience in gathering and analyzing historical narratives and forms of data.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Integration Experience, NUpath Interpreting Culture

**ENGL 3467. Paper Mechanics and Package Design. (4 Hours)**

Links paper, widely used in packaging, to work done by designers in systems of production, consumption, waste, and natural ecologies. Examines the ethical, social, and environmental responsibilities in the design of mass-produced objects and the role of paper in sustainability initiatives as a substitute for plastics. Uses design methods for material exploration, prototyping, and evaluation to deliver rich experiences. Offers students an opportunity to learn how to assess the impact of design decisions by following design through the stages of a packaging system: manufacturing, storage, merchandising, use, and product end-of-life.

**Prerequisite(s):** ARTG 2242 with a minimum grade of D- or ARTG 2252 with a minimum grade of D- or ARTG 2400 with a minimum grade of D- or ARTG 3462 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**ENGL 3487. Film and Text (Abroad). (4 Hours)**

Studies the similarities and differences between literary texts and film versions of those texts or the interrelations between film and literature as a means of cultural expression in a specific country outside the United States. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience, NUpath Interpreting Culture

**ENGL 3619. Emerson and Thoreau. (4 Hours)**

Focuses on Ralph Waldo Emerson and Henry David Thoreau, two major American Romantic writers whose ideas about the individual, spirituality, nature, and politics have had a wide-ranging impact on American culture. Readings include essays, poetry, and journals by these two Massachusetts-based authors.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGL 3678. Bedrooms and Battlefields: Hebrew Bible and the Origins of Sex, Gender, and Ethnicity. (4 Hours)**

Considers stories from Hebrew Scripture in English translation, beginning with the Garden of Eden through the Book of Ruth, asking how these foundational narratives establish the categories that have come to define our humanity. Analyzes how the Bible's patterns of representation construct sexual and ethnic identities and naturalize ideas about such social institutions as "the family".

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture

**ENGL 3700. Narrative Medicine. (4 Hours)**

Introduces students to the field of narrative medicine, which explores literary analysis as a set of tools for medical practice. Offers students an opportunity to develop close reading and analytical skills that are useful for improving doctor-patient relationships and patient care. Requires students to complete essays that cultivate these skills.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture

**ENGL 3710. Major Seminar. (4 Hours)**

Offers English majors in-depth study organized around an important critical question in English studies. Presents a framework, in a seminar setting, for students to examine disciplinary theories, methods, and practices. Offers students an opportunity to reflect upon their experiences in and paths through the major in seminar projects.

**Prerequisite(s):** ENGL 1400 with a minimum grade of D- or ENGL 1160 with a minimum grade of D- or ENGL 1410 with a minimum grade of D-

**ENGL 3900. Gender and Black World Literatures. (4 Hours)**

Explores different aspects of the literary and cultural productions of black women throughout history. Examines writing by women in the United States—like Octavia Butler, Zora Neale Hurston, and Toni Morrison—in addition to writing by women across the global African diaspora—like Chimamanda Adichie and Jamaica Kincaid. Students may also engage with theories such as Black feminism, womanism, or intersectionality; consider issues of genre such as the novel, poetry, or science fiction; and explore key themes such as class, sexuality, and disability. AFRS 3900, WMNS 3900, and ENGL 3900 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**ENGL 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENGL 4010. Topics in Shakespeare. (4 Hours)**

Examines a focused topic, theme, or critical approach to Shakespeare. May be repeated twice up to a total of 12 SH.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGL 4710. Capstone Seminar. (4 Hours)**

Offers an advanced senior seminar organized around an important critical question in the discipline. This writing-intensive course is designed to be a summative experience for English majors, offering in-depth study of the theories, methods, and practices of critical work on a particular topic while providing students opportunities for reflecting on the connections between their capstone and other work they have done as majors. Offers students an opportunity to produce significant research projects on the critical issues raised by the seminar. May be repeated once.

**Prerequisite(s):** (ENGL 3301 with a minimum grade of C or ENGL 3302 with a minimum grade of C or ENGL 3303 with a minimum grade of C or ENGL 3304 with a minimum grade of C or ENGL 3305 with a minimum grade of C or ENGL 3306 with a minimum grade of C or ENGL 3307 with a minimum grade of C or ENGL 3308 with a minimum grade of C or ENGL 3309 with a minimum grade of C or ENGL 3310 with a minimum grade of C or ENGL 3311 with a minimum grade of C or ENGL 3313 with a minimum grade of C or ENGL 3314 with a minimum grade of C or ENGW 3301 with a minimum grade of C or ENGW 3302 with a minimum grade of C or ENGW 3303 with a minimum grade of C or ENGW 3304 with a minimum grade of C or ENGW 3305 with a minimum grade of C or ENGW 3306 with a minimum grade of C or ENGW 3307 with a minimum grade of C or ENGW 3308 with a minimum grade of C or ENGW 3309 with a minimum grade of C or ENGW 3310 with a minimum grade of C or ENGW 3311 with a minimum grade of C or ENGW 3313 with a minimum grade of C or ENGW 3314 with a minimum grade of C or ENGW 3315 with a minimum grade of C); ENGL 3710 with a minimum grade of C

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**ENGL 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated without limit.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C

**ENGL 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGL 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENGL 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated once.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Integration Experience

**ENGL 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGL 5103. Proseminar. (4 Hours)**

Introduces the history and current scholarly practices of English studies. Surveys theoretical, methodological, and institutional issues in the development of the discipline; introduces students to the research of the English department's graduate faculty; and offers opportunities for the practice of key components of scholarly production, including formulating research questions, using databases, conducting literature reviews, and writing and presenting scholarship in common formats other than the long research paper, such as conference proposals, oral presentations, and book reviews.

**ENGL 5976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**ENGL 6301. Fiction Workshop. (4 Hours)**

Focuses on the craft of fiction writing. Students read and write in a variety of fiction genres. Experiments with a range of forms and techniques, placing them within historical context and the critical tradition, and examines the implications of form. Offers students an opportunity to build self-critique and editorial abilities through peer review and to build a final well-developed and structurally sophisticated work of fiction toward professional publication standards.

**ENGL 6302. Poetry Workshop. (4 Hours)**

Focuses on the craft of poetry writing. Experiments with a range of forms and techniques, placing them within historical context and the critical tradition, and examining the implications of form. Offers students an opportunity to build self-critique and editorial abilities through peer review and to prepare their poetry to meet professional publication standards.

**ENGL 6303. Creative Nonfiction Workshop. (4 Hours)**

Focuses on the craft of nonfiction writing. Explores how writers apply narrative strategies and techniques to factual material. Students read and write a variety of nonfiction forms. Topics for narrative nonfiction writing apply to a wide array of disciplines, including the humanities, the sciences, and journalism. Experiments with a range of forms and techniques, placing them within historical context and the critical tradition, and examining the implications of form. Offers students an opportunity to build self-critique and editorial abilities through peer review and to build a final well-developed and structurally sophisticated work of nonfiction toward professional publication standards.

**ENGL 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**ENGL 6955. Co-op Work Experience Abroad – Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated without limit.

**ENGL 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENGL 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated twice.

**ENGL 6965. Co-op Work Experience Abroad. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated without limit.

**ENGL 7215. Topics in 20th- and 21st-Century Literatures. (4 Hours)**

Examines an issue or issues in 20th- and 21st-century literatures such as gender and sexuality, surrealism in modern and contemporary poetry, naturalism and the city in the modern novel, autobiography, and race and ethnicity. May be repeated twice.

**ENGL 7281. Topics in Medieval Literature. (4 Hours)**

May consider the following: Anglo Saxon literature (including poems such as Beowulf, Judith, The Wanderer, The Seafarer, and a selection of prose); the poems of the Pearl Poet (Sir Gawain and the Green Knight, Pearl, Cleanness); women and/in the Middle Ages; medieval literature and medievalism; the medieval romance, Malory's Morte Darthur; religious, mystical, and didactic works; medieval travel literature; or William Langland's Piers Plowman. May be repeated without limit.

**ENGL 7282. Topics in Renaissance Literature. (4 Hours)**

Considers specific topics in the literature of the sixteenth and seventeenth centuries, such as the sonnet sequence, Renaissance women, and utopian and travel literature. May be repeated without limit.

**ENGL 7284. Topics in 18th-Century Literature. (4 Hours)**

Explores in depth a topic, theme, or genre in eighteenth-century British literature, such as satire; London's city culture; literary theory; the emerging women writers; the essay; or a major writer, for example, Jonathan Swift, Jane Austen, or Henry Fielding. May be repeated without limit.

**ENGL 7286. Topics in 19th-Century Literatures. (4 Hours)**

Focuses on health humanities, slave narratives, American literature, British literature, transatlanticism, and gender and racial capitalism in 19th-century literature. May be repeated twice.

**ENGL 7342. Topics in Criticism and Theory. (4 Hours)**

Examines such topics in critical theory as narratology, cultural criticism, representation, reader response, feminism, postcolonial studies, queer and decolonial theories, and theories and criticism in rhetoric and composition studies. May be repeated twice.

**ENGL 7351. Topics in Literary Study. (4 Hours)**

Focuses on literature on a thematic, formal, or generic basis. Varies by instructor.

**ENGL 7352. Topics in Genre. (4 Hours)**

Examines such topics in genre criticism as biography, autobiography, satire, and children's literature. May be repeated without limit.

**ENGL 7358. Topics in Cultural and Interdisciplinary Studies. (4 Hours)**

Examines such subjects as literature and the visual arts, literature and psychology, and literary impressionism. May be repeated twice.

**ENGL 7360. Topics in Rhetoric. (4 Hours)**

Focuses on specialized topics in rhetoric, such as visual rhetoric, rhetorical criticism, rhetoric of science, issues in contemporary rhetorical theory, and rhetoric and cultural studies. Varies by semester. May be repeated without limit.

**ENGL 7370. Introduction to Digital Humanities. (4 Hours)**

Offers a critical orientation to the tools, methods, and intellectual history of the digital humanities (DH). Explores key questions such as what debates are (re)shaping DH in this moment; what central theories lead humanities scholars to experiment with computational, geospatial, and network methodologies; how visualization can illuminate literature, history, writing, and other humanities subjects; and how new modes of research and publication might influence our teaching. Balances theory and praxis: Successful students come away with a well-grounded understanding of the DH field and a set of foundational skills to support their future research. No prior technical expertise is required to take the course, but students should be willing to experiment with new skills.

**ENGL 7380. Topics in Digital Humanities. (4 Hours)**

Explores specific analytical techniques such as mapping, computational text analysis, or network analysis; a particular methodological tradition such as digital scholarly editing; the history of a particular debate, research problem, or theoretical orientation such as intersectional feminism; or the intersection of digital humanities and another domain such as writing studies. Offers students an opportunity to develop more specialized skills and methods that support advanced research and teaching in digital humanities. May be repeated three times.

**ENGL 7392. Writing and the Teaching of Writing. (4 Hours)**

Engages MA and PhD students in the theory, practice, and praxis of teaching writing at the university level, drawing on recent scholarship in rhetoric and writing studies. Explores theories and practices regarding the nature of written expression; the role of diversity, inclusion, and equity in writing instruction; the research on how people learn to write and how that writing might be assessed; the historical contexts for required writing in U.S. higher education; the nature of multimodal composing; and the environments and activities that best help students learn writing.

**ENGL 7395. Topics in Writing. (4 Hours)**

May include the following topics: literacy and literacies; basic writing; issues of gender, race, and class in the classroom; writing assessment; or collaborative learning. May be repeated without limit.

**ENGL 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENGL 7976. Directed Study. (1-4 Hours)**

Offered by arrangement. May be repeated without limit.

**ENGL 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**ENGL 7990. Thesis. (4 Hours)**

Offers thesis supervision by members of the department. May be repeated without limit.

**ENGL 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers thesis supervision by members of the department.

**Prerequisite(s):** ENGL 7990 with a minimum grade of C-

**ENGL 8407. Teaching Practicum. (1 Hour)**

Gives students the opportunity to observe a senior faculty member teaching an undergraduate course in American or British literature, literary studies, rhetoric, composition studies, or linguistics. Students meet regularly with the faculty member to discuss teaching practices and other pedagogical issues and submit a term project discussing the experience in the context of the scholarship of teaching. May be repeated without limit.

**ENGL 8960. Exam Preparation—Doctoral. (0 Hours)**

Offers the student the opportunity to prepare for the PhD qualifying exam under faculty supervision. May be repeated three times.

**ENGL 8986. Research. (0 Hours)**

Offers the student the opportunity to conduct full-time research. May be repeated without limit.

**ENGL 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**ENGL 9986. Research. (0 Hours)**

Offers the student the opportunity to conduct full-time research. May be repeated up to three times.

**ENGL 9990. Dissertation Term 1. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** ENGL 9000 with a minimum grade of S

**ENGL 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** ENGL 9990 with a minimum grade of S

**ENGL 9996. Dissertation Continuation. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** ENGL 9991 with a minimum grade of S or Dissertation Check with a score of REQ

**English - CPS (ENG)****ENG 1105. College Writing 1. (3 Hours)**

Offers students an opportunity to develop written communication skills and basic research techniques in preparation for college writing in their majors. Incorporates reading, research, and critical thinking in the development of expository writing, the kind of objective, audience-directed prose used in college and the workplace to explain and defend ideas. Emphasizes planning, drafting, revising, and correct citation in essays, along with development of focus, organization, and paragraph/sentence structure. Offers opportunities for in-class assignments and peer-review activities in addition to extended essays developed outside of class. Students must pass with a C or higher in order to receive credit and continue to ENG 1107.

**Corequisite(s):** ENG 1106

**ENG 1106. Lab for ENG 1105. (1 Hour)**

Requires students to analyze and draft writing assignments from topics covered in ENG 1105.

**Corequisite(s):** ENG 1105

**ENG 1107. College Writing 2. (3 Hours)**

Builds on students' skills of written communication and basic research in preparation for college writing in their majors. Offers opportunities to emulate and incorporate various rhetorical strategies in the development of written analysis and researched argumentation. Focuses on techniques for logical analysis (inductive and deductive reasoning) and effective reasoning, establishing credibility, and emotional appeals to develop persuasive arguments. Emphasizes planning, drafting, revising, and correct citation in essays. Offers opportunities for in-class assignments and peer-review activities in addition to extended essays developed outside of class. Students must pass with a C or higher in order to receive credit and continue to ENG 3105 or ENG 3107.

**Prerequisite(s):** ENG 1103 with a minimum grade of C or ENG 1105 with a minimum grade of C

**Corequisite(s):** ENG 1108

**ENG 1108. Lab for ENG 1107. (1 Hour)**

Requires students to analyze and draft writing assignments from topics covered in ENG 1107.

**Prerequisite(s):** ENG 1106 with a minimum grade of S

**Corequisite(s):** ENG 1107

**ENG 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENG 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**ENG 3105. Writing for the Professions: Science and Engineering. (3 Hours)**

Offers writing instruction for students considering careers or advanced study in fields of science, technology, engineering, and mathematics. Students practice and reflect on writing in professional, public, and academic genres as they plan, research, write, and analyze various forms of technical communications such as technical reports, progress reports, proposals, instructions, presentations, and technical reviews relevant to technical professions and individual student goals. Offers students opportunities to evaluate a wide variety of sources and to develop communication skills in audience analysis, critical research, peer review, and revision. Students must pass with a C or higher in order to receive credit.

**Prerequisite(s):** ENG 1107 with a minimum grade of C ; ENG 1108 with a minimum grade of S

**Corequisite(s):** ENG 3106

**ENG 3106. Lab for ENG 3105. (1 Hour)**

Requires students to analyze and draft writing assignments from topics covered in ENG 3105. *Coreq ENG 3105..*

**Corequisite(s):** ENG 3105

**ENG 3107. Writing for the Professions: Business and the Social Sciences. (3 Hours)**

Offers writing instruction for students considering careers or advanced study in business administration and the social sciences. Students practice and reflect on writing in professional, public, and academic genres as they plan, research, write, and analyze various forms of business communications such as proposals, recommendation reports, letters, presentations, and emails relevant to industry. Offers students opportunities to evaluate a wide variety of sources and to develop communication skills in audience analysis, critical research, peer review, and revision. Students must pass with a C or higher in order to receive credit.

**Prerequisite(s):** ENG 1107 with a minimum grade of C ; ENG 1108 with a minimum grade of S

**Corequisite(s):** ENG 3108

**ENG 3108. Lab for ENG 3107. (1 Hour)**

Requires students to analyze and draft writing assignments from topics covered in ENG 3107. *Coreq ENG 3107..*

**Corequisite(s):** ENG 3107

**ENG 3220. Writing Poetry. (3 Hours)**

Introduces techniques and styles of poetry. Focuses on fundamentals and philosophy of poetry, including rhythm, rhyme, line breaks, and originality. Examines the roles of audience, speaker, and message in poetry with an emphasis on historically marginalized and under-represented voices. Class discussion emphasizes the role of the literary journal in 21st-century poetry and media. Offers students an opportunity to develop insights grounded in the reading, sharing, and analysis of current poetry published in literary journals/magazines to determine their place in the poetry community as creators, consumers, and/or curators. Students define poetry and its role in their life; craft, revise, and polish their original poems; critique their work and the work of others in discussion boards; and explore avenues for publication.

**Prerequisite(s):** ENG 1107 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**ENG 3230. Writing Fiction. (3 Hours)**

Introduces techniques and strategies of fiction writing. Examines key communication elements of fiction, including plot, characterization, setting, point-of-view, and various story development techniques. Students have an opportunity to read and react to a variety of texts while completing writing exercises and while generating, developing, and revising original pieces of fiction. Provides time for students to critique their own work and the work of others in writing workshops and peer review sessions.

**Prerequisite(s):** ENG 1107 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**ENG 3240. Writing Nonfiction. (3 Hours)**

Explores how writers translate personal experience and research into effective pieces of creative nonfiction. Studies literary journalism, personal essays, memoir, nature writing, and other subgenres to enhance understanding of this communication strategy. Class discussions analyze published works through points of view of scholar and writer, while delving into ethical considerations of writing from "real" life. Considers accurate description, scenic representation, and narrative framing, along with meaningful integration of images, videos, and Web tools. Offers students an opportunity to develop and revise original works of creative nonfiction. Provides time for students to critique their work and the work of others in writing workshops and peer-review sessions.

**Prerequisite(s):** ENG 1107 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**ENG 3260. Writing to Inform and Persuade. (3 Hours)**

Focuses on techniques used in nonfiction writing to communicate ideas and influence audience point of view about "true" events or affairs. Examines a variety of nonfiction pieces and styles, such as journalism features and profiles, editorials and opinion pieces, literary essays, and visual arguments. Offers students an opportunity to advance their understanding and appreciation of informative, persuasive writing techniques as they discuss, develop, revise, and review each other's original nonfiction pieces.

**Prerequisite(s):** ENG 1107 with a minimum grade of D-

**Attribute(s):** NUpath Writing Intensive

**ENG 3300. Literature and Business Leadership. (3 Hours)**

Examines organizational leadership by studying fictional characters whose workplace challenges parallel those encountered by today's business executives. Analyzes a variety of management styles and strategies as depicted in story form to guide students' understanding of leadership as it applies to workplace responsibility, choice, risk taking, moral obligation, and self-mastery. Offers students an opportunity to use insights gained from literary examples to inform personal reflections on the meaning of leadership and the qualities that combine to make someone an effective manager of people and organizations.

**Prerequisite(s):** ENG 1103 with a minimum grade of D- or ENG 1105 with a minimum grade of D-

**ENG 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENG 4950. Seminar. (1-4 Hours)**

Offers students the opportunity to integrate knowledge and abilities gained throughout the program. This capstone course for English majors concludes with a detailed research project.

**ENG 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**ENG 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENG 4991. Research. (1-4 Hours)**

Offers students an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**ENG 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**English as a Second Language - CPS Specialty (ESLG)**

Code	Title	Hours
ESLG 0045	Reading in the Field of Study	3
ESLG 0080	Career Exploration 1	1

ESLG 0095	Advanced Reading and Writing	4
ESLG 0120	Community Learning 1	1
ESLG 0130	Community Learning 2	1
ESLG 0224	Core Structure and Vocabulary	3
ESLG 0230	Writing for Graduate School	4,5
ESLG 0234	Culture and Communication Skills for Graduate School	4
ESLG 0510	Advanced Reading for Graduate School	3
ESLG 0520	Advanced Listening and Speaking for Graduate School	3
ESLG 0521	Advanced Listening and Speaking for Graduate School	4
ESLG 0550	Research and Writing for Graduate School	5,6
ESLG 0700	Advanced Listening and Speaking	3
ESLG 0720	Critical Writing	4

## English Writing (ENGW)

### ENGW 1102. First-Year Writing for Multilingual Writers. (4 Hours)

Designed for students whose first or strongest language is not English. Parallels ENGW 1111 but focuses on the concerns of multilingual writers. Students study and practice writing in a workshop setting; read a range of texts in order to describe and evaluate the choices writers make and apply that knowledge to their own writing; explore how writing functions in a variety of academic, professional, and public contexts; and write for various purposes and audiences in multiple genres and media. Offers students an opportunity to learn how to conduct research using primary and secondary sources and to give and receive feedback, to revise their work, and to reflect on their growth as writers.

### ENGW 1110. Introductory First-Year Writing. (4 Hours)

Offers students an opportunity to develop awareness of their rhetorical practices, engage with critical perspectives, and identify and employ effective research techniques in a workshop setting. Throughout the course, students give and receive feedback, revise their work, and reflect on their identities as writers.

### ENGW 1111. First-Year Writing. (4 Hours)

Designed for students to study and practice writing in a workshop setting. Students read a range of texts in order to describe and evaluate the choices writers make and apply that knowledge to their own writing and explore how writing functions in a range of academic, professional, and public contexts. Offers students an opportunity to learn how to conduct research using primary and secondary sources; how to write for various purposes and audiences in multiple genres and media; and how to give and receive feedback, to revise their work, and to reflect on their growth as writers.

### ENGW 1113. First-Year Writing Innovation Seminar. (4 Hours)

Covers special topics and novel approaches to teaching and practicing writing in a workshop setting. Explores how writing functions in a range of academic, professional, and public contexts. Offers students an opportunity to learn how to conduct research using primary and secondary sources; how to write for various purposes and audiences in multiple genres and media; and how to give and receive feedback, to revise their work, and to reflect on their growth as writers.

### ENGW 1114. First-Year Writing with Service-Learning. (4 Hours)

Offers students an opportunity, in a workshop setting, to study and practice writing. Hands-on experience shapes the students' practice of writing, and writing projects meet specific community needs. Students read a range of texts in order to describe and evaluate the choices writers make and apply that knowledge to their own writing. Covers how to conduct research using primary and secondary sources and apply that knowledge in service-learning-focused settings. Studies how to write for various purposes and audiences in multiple genres and media, how to give and receive feedback, how to revise work, and how to reflect on growth as a writer.

### ENGW 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### ENGW 2990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENGW 3302. Advanced Writing in the Technical Professions. (4 Hours)**

Offers writing instruction for students in the College of Engineering and the College of Computer and Information Science. Students practice and reflect on writing in professional, public, and academic genres—such as technical reports, progress reports, proposals, instructions, presentations, and technical reviews—relevant to technical professions and individual student goals. In a workshop setting, offers students an opportunity to evaluate a wide variety of sources and develop expertise in audience analysis, critical research, peer review, and revision.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGW 3303. Advanced Writing in the Environmental Professions. (4 Hours)**

Provides writing instruction for students in fields related to environmental studies. Students develop an in-depth analytic or recommendation report about a complex environmental concern related to their majors and/or their co-op or other personal or professional experiences. In a workshop setting, students evaluate scholarly and popular sources, practice a variety of professional and academic forms of writing and communication, and develop expertise in audience analysis, critical research, peer review, and revision. Writing is guided in stages from initial topic exploration and a formal proposal through drafts and progress reports to a final polished report, presented in a bound portfolio with a cover letter, an abstract, and other writing samples.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGW 3304. Advanced Writing in the Business Administration Professions. (4 Hours)**

Offers writing instruction for students in the D'Amore-McKim School of Business. Students practice and reflect on writing in professional, public, and academic genres—such as proposals, recommendation reports, letters, presentations, and e-mails—relevant for careers in business. In a workshop setting, offers students an opportunity to evaluate a wide variety of sources and develop expertise in audience analysis, critical research, peer review, and revision.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGW 3306. Advanced Writing in the Health Professions. (4 Hours)**

Offers writing instruction for students in the Bouvé College of Health Sciences. Students practice and reflect on writing in professional, public, and academic genres—such as literature reviews, case studies, protocols, and care instructions—relevant for careers in nursing, pharmacy, and other health professions. In a workshop setting, offers students an opportunity to evaluate a wide variety of sources and develop expertise in audience analysis, critical research, peer review, and revision.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGW 3307. Advanced Writing in the Sciences. (4 Hours)**

Offers instruction in writing for students considering careers or advanced study in the physical or life sciences. By exploring research literature and reflecting on their own experiences, offers students an opportunity to identify issues of interest in their field and analyze how scientific texts make claims, invoke other scientific literature, offer evidence, and deploy key terms. Through analysis and imitation, exposes students to the challenges of the scientific project, such as the use of quantitative data and visual presentation of evidence. In a workshop setting, offers students an opportunity to evaluate a wide variety of sources and develop expertise in audience analysis, critical research, peer review, and revision.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGW 3308. Advanced Writing in the Social Sciences. (4 Hours)**

Offers instruction in writing for students considering careers or advanced study in the social sciences. By exploring research literature and reflecting on their own experiences, offers students an opportunity to identify issues of interest and analyze how texts make claims, invoke other social science literature, offer evidence, and deploy key terms. Through analysis and imitation, exposes students to the challenges of the social science project, including the collection of data on human subjects and the ethical presentation of evidence. In a workshop setting, offers students an opportunity to evaluate a wide variety of sources and develop expertise in audience analysis, critical research, peer review, and revision.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGW 3309. Advanced Writing in the Humanities. (4 Hours)**

Offers instruction in writing for students considering careers or advanced study in the humanities. By exploring critical literature and reflecting on their own experiences, offers students an opportunity to identify issues of interest and analyze how texts make claims, invoke primary and secondary texts, offer evidence, and deploy key terms. Through analysis and imitation, exposes students to the challenges of the humanities project, including the framing of interpretive questions and the presentation of textual evidence. In a workshop setting, offers students an opportunity to evaluate a wide variety of sources and develop expertise in audience analysis, critical research, peer review, and revision.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGW 3311. Advanced Writing for Prelaw. (4 Hours)**

Offers instruction in writing for students considering legal careers. Introduces students to legal reasoning and to the contexts, purposes, genres, audiences, and styles of legal writing. Emphasizes the role of writing and argument in U.S. legal culture. Using strategies drawn from rhetorical theory and criticism, students examine briefs, memoranda, opinions, and other legal texts to identify and describe techniques of analysis and persuasion. In a workshop setting, offers students an opportunity to evaluate a wide variety of sources and develop expertise in audience analysis, critical research, peer review, and revision.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGW 3314. Advanced Writing in the Arts, Media, and Design. (4 Hours)**

Examines writing in the arts and in the fields of media and design. Explores writing for a range of public and professional audiences, including scholarly and critical. Emphasizes understanding different literacies: alphabetic, visual, musical, and sculptural. Genres might include critical reviews, grant writing, promotional pieces, interactive narratives, newspaper articles, and Web pages, among others. Offers students an opportunity for analysis, reflexive imitation, and creative interdisciplinary work.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGW 3315. Interdisciplinary Advanced Writing in the Disciplines. (4 Hours)**

Offers writing instruction for students interested in interdisciplinary study or who wish to explore multiple disciplines. Students practice and reflect on writing in professional, public, and academic genres relevant to their individual experiences and goals. In a workshop setting, offers students an opportunity to evaluate a wide variety of sources and to develop expertise in audience analysis, critical research, peer review, and revision.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**ENGW 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENGW 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Enterprise Artificial Intelligence - CPS (EAI)****EAI 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EAI 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EAI 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EAI 5000. Fundamentals of Artificial Intelligence. (2.25 Hours)**

Introduces the fundamental problems, theories, and algorithms of the artificial intelligence field. Topics include heuristic search and game trees, knowledge representation using predicate calculus, automated deduction and its applications, problem solving and planning, and an introduction to machine learning. Required course work includes the creation of working programs that solve problems, reason logically, and/or improve their own performance using techniques presented in the course.

**EAI 6000. Fundamentals of Artificial Intelligence. (3 Hours)**

Introduces the fundamental problems, theories, and algorithms of the artificial intelligence field. Topics include heuristic search and game trees, knowledge representation using predicate calculus, automated deduction and its applications, problem solving and planning, and an introduction to machine learning. Required course work includes the creation of working programs that solve problems, reason logically, and/or improve their own performance using techniques presented in the course.

**EAI 6010. Applications of Artificial Intelligence. (3 Hours)**

Explores numerous industry applications of AI with emphasis on solving specific needs or problems. Topics include neural networks, natural language processing, and implications of cybersecurity. Artificial Intelligence is actively developing in applications across numerous fields and industries, including finance, healthcare, education, and transportation.

**EAI 6020. AI System Technologies. (3 Hours)**

Presents a selection of systems technologies utilized in AI, including data visualization; file systems for a large data mart; applications of structured query language; and filtering and transforming to ingest data, predictions, etc. Covers mathematics/statistics and computation, machine learning, and privacy requirements.

**Prerequisite(s):** EAI 6000 (may be taken concurrently) with a minimum grade of C- ; EAI 6010 (may be taken concurrently) with a minimum grade of C-

**EAI 6050. Finance Information Processing. (3 Hours)**

Covers advanced data management technologies and management systems with a focus on the finance industry. Emphasizes evaluating the advantages and disadvantages of such technologies in different application contexts. Addresses specific application contexts of AI and presents the entity relationship to data management (including network hierarchical and object oriented), with an emphasis on processing, storing, and retrieval, while also including privacy requirements.

**EAI 6060. Healthcare Information Processing. (3 Hours)**

Covers advanced data management technologies and management systems with a focus on the healthcare industry. Emphasizes evaluating the advantages and disadvantages of such technologies in different application contexts. Addresses specific application contexts of AI and presents the entity relationship to data management (including network hierarchical and object oriented), with an emphasis on processing, storing, and retrieval, while including privacy requirements.

**EAI 6070. Human Resources Information Processing. (3 Hours)**

Covers advanced data management technologies and management systems with a focus on human resources. Emphasizes evaluating the advantages and disadvantages of such technologies in different application contexts. Addresses specific application contexts of AI and presents the entity relationship to data management (including network hierarchical and object oriented), with an emphasis on processing, storing, and retrieval, while including privacy requirements.

**EAI 6080. Advanced Analytical Utilization. (3 Hours)**

Focuses on instrumental methods of data analysis and provides a foundation to the theory and application of modern analytical techniques for artificial intelligence. Explores the importance of instrumental analysis for specific uses of AI within various fields and context applications across numerous professional fields.

**EAI 6120. AI Communication and Visualization. (3 Hours)**

Offers an overview of key informational design concepts, emphasizing the relationship between information and audience in the context of communicating complex quantitative information. Encompasses three main context areas: exploratory data visualization, dashboard and scorecard design, and spatial data representation. Discusses ethical questions related to the communication and visualization of data analytics: storytelling; different techniques (such as R-spatial, GeoDa, GeoWave, GeoTrellis, GeoMesa, graph databases network visualization); and principles for visual design, including privacy requirements.

**EAI 6400. Data Governance and Responsible AI. (3 Hours)**

Focuses on data ethics, data privacy, data integrity, and protecting data from the viewpoint of an organization's internal and customer data. Covers the ethical challenges of AI and analytics systems, developing a model to provide a reliable and sustainable system complying with ethical standards, government regulations, and policies. Topics include data privacy, data regulations, bias in AI, and building a trustworthy AI system. Explores real-world scenarios and business cases, applying approaches to ethical issues organizations face throughout the complete lifecycle of analytics and AI models.

**EAI 6610. Applied Machine Learning. (3 Hours)**

Analyzes machine learning techniques, methodologies, and best practices tailored for advanced AI applications. Covers advanced supervised and unsupervised learning, deep learning architectures, reinforcement learning, and domain-specific applications. Explores crucial topics of ethics, privacy, and fairness in machine learning.

**EAI 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**EAI 6980. Integrated Experiential Capstone. (3 Hours)**

Offers students an opportunity to apply the knowledge, skills, and best practices acquired throughout the Enterprise Artificial Intelligence program in the context of a practicum in the development and delivery of discipline-specific artificial intelligence projects. Students advance a project plan, conduct research, and create and deliver recommendations with the objective to apply artificial intelligence to real-world problems in organizations. Students develop and present the insights and recommendations for successful implementation of the capstone project.

**Entrepreneurship and Innovation (ENTR)****ENTR 1201. The Entrepreneurial Universe. (4 Hours)**

Introduces students to the world of entrepreneurship. Covers the importance of entrepreneurship, the characteristics of entrepreneurs, and the entrepreneurship process. Describes entrepreneurship in its various forms, including startup growth ventures, entrepreneurship in small and medium enterprises, and microbusinesses.

**ENTR 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENTR 2215. Understanding Family Enterprise. (4 Hours)**

Covers business, personal, and family issues found in family owned and managed companies, including management of the business, succession planning, entitlement, hiring, nonfamily employees, boards of advisors and directors, compensation, managing conflict, and communications. Designed for individuals who plan to enter into the management of a family business. Focuses on small and midsize firms with annual revenue of \$5 million to \$500 million.

**ENTR 2225. Examining Family Business Dynamics Through Film. (4 Hours)**

Examines various television shows and films to critically analyze and evaluate family relationships and family business dynamics. Discusses how these media reflect research and theories related to family businesses and how a "healthy family" helps to ensure a "healthy business." Observes examples of important family psychology concepts like sibling rivalry, entitlement, generational conflict, gender stereotypes, divorce, and spousal conflict. Also covers family business concepts like primogeniture, entitlement, succession, stagnation, wealth management, innovation, and gender discrimination. Emphasizes understanding family businesses as a source and consequence of diversity, using a global lens to showcase the similarities and differences among family firms around the world.

**ENTR 2303. Marketing Strategies for Startups. (4 Hours)**

Designed to help aspiring and serious entrepreneurship students to generate and evaluate robust marketing opportunities that may serve as the foundation for a new venture. Once a new opportunity has been vetted, students then have an opportunity to work on developing an entrepreneurial marketing plan. Covers methods for recognizing, discovering, or creating opportunities and validating those opportunities. One of the biggest challenges entrepreneurs face is coming up with the right opportunity for a new venture. This is an applied and experiential course involving field research. Two key deliverables are the opportunity assessment project and the entrepreneurial marketing plan.

**ENTR 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENTR 3217. Global Family Business Leadership. (4 Hours)**

Offers students an opportunity to develop an understanding of the nuanced challenges facing entrepreneurial leaders in different cultural settings. While family businesses have been found to be both numerically and economically significant in most countries, these enterprises worldwide share many common issues. However, there are differences that emanate from specific institutional and cultural contexts. Understanding these differences and how they can affect leadership of a family business is increasingly important for stewards of family businesses in a global marketplace. Understanding the nature of international differences and appreciating the opportunities they offer for growth-oriented family business leaders is especially important as family businesses face unique barriers to international expansion. Required participation in spring break international field project.

**ENTR 3220. International Entrepreneurship and Innovation Consulting. (4 Hours)**

Offers students an opportunity to learn the principles and methods of consulting to growing companies and social enterprises abroad. This is done through a set of frameworks that focus on customer segmentation, product or service requirements, product-line and service strategy, business model design, and then internationalization strategy. Working in teams, students apply these frameworks to local companies in different business sectors and then prepare to apply them to client companies in their follow-on designated destination country. The final part of the course is preparation for the international field studies. This includes an introduction to effective methods for management consulting, including goal setting, team organization, and client management.

**ENTR 3304. Entrepreneurship and Innovation Law. (4 Hours)**

Surveys many of the legal issues associated with starting and operating a business. Includes choice of entity, selection of a company name and trademark, financing arrangements, protecting the intellectual property of the new company, and formulating business agreements while avoiding risk or exposure. Covers issues affecting social entrepreneurs; introduces the legal problems they are likely to encounter in an entrepreneurial setting as owners of an equity position in the enterprise.

**ENTR 3305. Business Model Design and Innovation. (4 Hours)**

Considers dynamic entrepreneurial startup strategy from three perspectives: positioning of the venture within a dynamic, evolving industrial ecosystem that includes major companies, startups, and universities at various parts of the value-chain; different sources of innovation, including open innovation and industry-wide technology platforms; and business model design and implementation. Explores startup strategy from these perspectives using case studies and web-based company research projects and then asks students to develop their own strategy for a startup using the frameworks studied in class.

**ENTR 3306. Global Entrepreneurship. (4 Hours)**

Offers an opportunity to learn how entrepreneurs start, finance, and manage small businesses. Includes a field experience in South Africa, which involves identifying startups and small business for assistance in developing a business plan and seeking debt and/or equity financing. Students have an opportunity to consider the unique challenges encountered by entrepreneurs in economically disadvantaged communities and the additional challenges presented by South Africa's history of racism and its current struggles with HIV/AIDS. Teaches students the basic concepts and tools associated with small business management, such as preparing financial models and a written business plan and investment presentation, with the goal that they can provide meaningful consulting assistance to township entrepreneurs.

**Attribute(s):** NUpath Creative Express/Innov

**ENTR 3330. Design Thinking for Startups. (4 Hours)**

Focuses on how small teams can develop new products and services in a startup environment by applying design thinking methodology. Applies the management concept of lean, agile development to concept creation, customer research, prototype development, and market validation. Offers students an opportunity to apply these skills to their own new product or service ideas and develop prototypes during the semester. Students are assessed not only for the quality of their ideas and project execution but also for their ability to work in small teams, with limited resources, as in a traditional startup experience.

**ENTR 3401. Consulting Operations and Growth in Small and Medium Enterprises. (4 Hours)**

Offers teams of students an opportunity to consult with owners of small- and medium-sized enterprises (SMEs) to develop project proposals and perform field casework specific to the needs of their SME clients. A highlight of this course is the SME consulting project. Through the project and course material, covers how to manage an SME from the day-to-day operations to strategic planning for growth. Exposes students to a variety of ways that an SME can achieve profitability and growth by generating lasting customer relationships, offering exemplary service, managing cash flow, implementing marketing strategies, and developing new and retooled products/services to reach new markets.

**ENTR 3945. New Venture Development: Startup Immersion. (4 Hours)**

Explores the process of discovering, firsthand, how startups are built, finding a "white space," and developing solutions to address the unmet need. Students are paired with startups and complete a semester-long startup immersion internship project, with faculty in a mentorship capacity. Classroom sessions support the development of project value proposition, market opportunity, technology development level, financials, go-to-market strategy, and pitches.

**ENTR 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENTR 4414. Bridging Conflict, Creating Diversity. (4 Hours)**

Offers students a unique opportunity to serve as management and marketing consultants to early stage startups. Students work with entrepreneurs from diverse backgrounds (e.g., ethnic, social, religious, demographic) with experience operating a joint startup. Focuses on development of conflict resolution and leadership development skills that may be needed when cofounders of a startup come from diverse backgrounds. Students experience firsthand some of the challenges that entrepreneurs face, as well as support entrepreneurs' efforts as problem solvers and collaborate to learn about entrepreneurship and marketing.

**ENTR 4501. Integrated Studies in Entrepreneurial Startups. (4 Hours)**

Designed as an advanced course for students who are studying entrepreneurship. Covers the issues raised when creating a technology venture that goes through multiple rounds of financing in order to become a successful large company. Topics include managing growth, writing business plans, raising money, and formulating exit strategies. Focuses on projects to obtain venture financing from venture capitalists, angels, and corporate investors.

**ENTR 4505. Entrepreneurial Venture Growth Strategies. (4 Hours)**

Focuses on helping technology ventures define and improve their strategies and tactics to achieve external funding. Studies frameworks for developing a growth-focused product and service strategy; techniques to grow and evolve a startup team, creating scalable business models; and early stage, successive-round venture finance. Working in teams, students must apply these methods to improve the business plans for early stage technology ventures and to create new financial projections and investor packages for early stage ventures, with specific assessments of customer focus and needs, intellectual property, new product-line and technology strategy, and business model design. Company projects include the fields of web services, IT, healthcare, and life sciences. The course is a practicum on how to get new venture concepts funded and scaled from the perspective of entrepreneur and investor.

**ENTR 4510. Management Consulting Abroad. (4 Hours)**

Offers an intensive field consulting program with local ventures in different countries. Designed to have students experience firsthand the challenges that entrepreneurs confront internationalizing products and services as well as core product management issues. In some cases, students work in cross-culture consulting teams with local stakeholders. Projects vary widely but typically involve assessment of current product line and services strategy, marketing approaches, and how these must be adapted for foreign markets, including the United States. This is a field consulting course with heavy client engagement, requiring detailed written and oral communications for the client.

**Prerequisite(s):** ENTR 2301 (may be taken concurrently) with a minimum grade of D- or ENTR 3220 (may be taken concurrently) with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov, NUpath Integration Experience

**ENTR 4983. Special Topics in Entrepreneurship. (4 Hours)**

Covers special topics in entrepreneurship. May be repeated once.

**ENTR 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENTR 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**ENTR 5000. New Venture Development. (1-4 Hours)**

Pairs students with entrepreneurs and faculty in a mentorship capacity. This experiential learning is designed to accelerate entrepreneurial projects. Uses classroom learning to enhance project value proposition, market opportunity, technology development level, financials, go-to-market-strategy, and pitches.

**ENTR 6210. Managing Operations in Early Stage Ventures. (3 Hours)**

Stresses the operating problems of managing small businesses. Case studies develop analytical approaches for appraising the risks and rewards of potential growth opportunities as well as operating problems. Problems range from locating, evaluating, marketing, and financing a small company to the survival and growth of more established businesses. Guest speakers and entrepreneurs provide pertinent business perspectives to in-class activities.

**ENTR 6211. Entrepreneurship: Services and Retail Business Creation. (3 Hours)**

Covers the issues surrounding the creation of a new business in the service and retail sectors. Emphasizes issues relating to the startup, growth, and operation of business ventures in these areas. Topics include developing a business plan for startup, market positioning, services design, operations management, sales forecasting, cash flow management, and venture financing with a heavy emphasis on debt financing. Students are asked to develop business plans for services and retail ventures of their own choosing as the class project. Requires prior completion of 9 SH of MBA core courses.

**ENTR 6212. Business Planning for New Ventures. (3 Hours)**

Gives students the opportunity to build a complete business plan for new high-potential ventures. Covers all aspects of the planning process, from the point of view of both the prospective entrepreneur and the potential investor. Explores the demands of the entrepreneurial career through reading, self-assessment exercises, and group projects. Guest speakers from startup companies, law firms, and venture capital firms provide a window on current experiences in the small-business world. Recommended for prospective entrepreneurs as well as others who may become involved with new ventures.

**ENTR 6214. Social Enterprise. (3 Hours)**

Designed to provide students with an in-depth exposure to entrepreneurship in the social sector, a rapidly growing segment of the global economy. Uses the case method to expose students to leading entrepreneurs who have developed and implemented business models to solve social problems such as extreme poverty, disease, illiteracy, and economic and social dislocation. Focuses on uniquely creative and driven people who have dedicated their lives to making a difference in the lives of others through values-based entrepreneurship.

**ENTR 6216. Global Social Entrepreneurship and Innovation. (3 Hours)**

Explores using innovation to build and create value in the larger global context. Examines some of the latest innovation practices: (1) to build and create value within emerging economies, (2) to facilitate social entrepreneurship, (3) to promote sustainable development, and (4) to build and create value at the bottom of the pyramid. Exposes students to what successful entrepreneurs must learn to balance business demands with the larger need for innovative thinking. Stresses the application of successful practices to generate results. Topics include creating and sharing knowledge and intellectual property, exploiting systems and networks, redefining disruptive innovation, and the steps necessary to make innovation and entrepreneurship happen in a variety of global contexts. Uses real-life examples and case studies to illustrate successful practices.

**ENTR 6218. Business Model Design and Innovation. (3 Hours)**

Introduces major topics in the modern understanding of business models: their essence and role in securing competitive advantage, key components and design of business models, business model change and innovation, technology commercialization through sustaining business models, financial representation of a business model, and validation of developed business models.

**ENTR 6240. Emerging and Disruptive Technologies. (3 Hours)**

Covers the role emerging technologies play in innovation for new ventures and established corporations. Includes a mix of theory and practical knowledge. Topics covered include technology disruption, diffusion, life cycles, and research-and-development strategy. Explores, in detail, the technical and market opportunities for current and emerging technologies across a broad spectrum of industries.

**ENTR 6241. Entrepreneurial Marketing and Selling. (3 Hours)**

Examines the specific situation of entrepreneurial marketing. Topics include how to perform a market analysis when there are limited resources and tight schedules to be met. Also addresses new market situations, opportunity assessment, customer segmentation, going to market, and writing a marketing plan.

**ENTR 6250. Lean Design and Development. (3 Hours)**

Covers the intersection of customer research with product design, specifically lean design and how to map abstract attributes that customers seek into concrete product designs that can actually be built. Other topics include managing the technology business interface, creating product teams, and drafting product development plans. Open to first-year graduate students.

**ENTR 6300. Managing a Technology-Based Business. (3 Hours)**

Covers topics specific to managing a business or a strategic business unit within a firm. Considers the special issues related to technology-based firms. Topics include creating a culture, operations planning, staffing for technical excellence, dealing with technology vendors, dealing with advisers, supply chain management, and writing operations plans. Open to first-year graduate students.

**ENTR 6340. The Technical Entrepreneur as Leader. (3 Hours)**

Focuses on the personal skills an entrepreneur needs to lead and persuade others. Students read about and complete exercises on leadership and selling ideas. In addition, students meet members of the entrepreneurship community in New England. Stresses communications skills, both written and oral, along with self-discovery of leadership style.

**ENTR 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENTR 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

**Environmental Science - CPS (ESC)****ESC 1150. The Atmosphere. (3 Hours)**

Examines Earth's atmospheric structure and applies laws of physics to describe and explain broad climate and circulation patterns and local weather events that maintain or can disrupt ecosystems as heat energy and water move through Earth's spheres.

**Attribute(s):** NUpath Natural/Designed World

**ESC 1200. The Hydrosphere: Oceanography, Ground and Surface Water. (3 Hours)**

Examines the physical structure, biological provinces, and varying chemistries of Earth's ocean and other water resources. Topics range from El Nino/Southern Oscillation to lake eutrophication.

**Attribute(s):** NUpath Natural/Designed World

**ESC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ESC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ESC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ESC 4955. Project. (1-4 Hours)**

Reviews the theory and practice of environmental permitting and environmental assessment. Topics include major federal and state environmental regulations, the environmental permitting process, risk assessment and management, and environmental compliance. May be repeated without limit.

**ESC 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Environmental Studies (ENVS)

**ENVS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENVS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENVS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENVS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ENVS 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**ENVS 4997. Senior Thesis. (4 Hours)**

Offers students an opportunity to prepare an undergraduate thesis under faculty supervision.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

## Extended Realities (EXRE)

**EXRE 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**EXRE 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**EXRE 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**EXRE 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**EXRE 5010. Immersive Media: Extended Realities (XR) History, Theory, and Impact. (4 Hours)**

Introduces the historical foundation and conceptual frameworks with which to analyze and interrogate extended reality experiences, including virtual reality, augmented reality, and mixed reality. Covers the theoretical, cultural, and technological developments that have informed contemporary XR. Explores the promises, dreams, and expectations, as well as the ethical concerns and philosophical dilemmas, associated with the field. Offers students an opportunity to create XR experiences and prototype their own ideas.

**EXRE 5011. Seminar for EXRE 5010. (1 Hour)**

Offers students an opportunity to analyze and critique extended reality experiences. Examines historical, seminal, and new experiences. Discusses the XR experiences using industry nomenclature and basic research methodology.

**Corequisite(s):** EXRE 5010

**EXRE 5020. Developing Extended Realities (XR). (4 Hours)**

Examines how to create extended reality (XR) experiences including virtual reality (VR), augmented reality (AR), and mixed reality (MR). Studies coding and developing projects in XR using current hardware and software, including scripting, sensing, interactions, and preproduction methods that are specific to XR. Examines simulation sickness, sensing, eye tracking, empathy, and narrative in XR.

**EXRE 5030. Designing Extended Realities (XR). (4 Hours)**

Studies the craft and theory of designing, executing, and directing compelling extended reality experiences. Covers techniques to analyze, advise, and critique designs in the XR industry, or the many industries this experience augments, via a hands-on, experiential learning approach. Offers practical, professional, and theoretical instruction in writing and design, spatial narrative, and world building. Presents methodologies for formatting and directing interactive scripts and voice-overs. Shares professional methods as well as strategies and approaches to world building in the metaverse. Explores all forms in the broad field of extended reality, including games, animation, 360 video, journalism, and advertising. Offers networking opportunities through invited guests, publishers, and partners in XR.

**EXRE 5973. Topics in Extended Realities (XR). (4 Hours)**

Focuses on a specific topic that is of timely relevance to the domain of extended reality. Explores current discourses in the field and draws directly from ongoing instructor expertise and research. Offers students an opportunity to develop original projects in response to course topic, informed by case studies, critical readings, instructor and guest lectures, class discussions, and exercises. Emphasizes developing skills and strategies for self-directed XR experience production, including experimentation, planning, development, iteration, revision, and critique of creative work. May be repeated once.

**EXRE 6500. Extended Realities (XR) Studio. (4 Hours)**

Focuses on the design of experiences and artifacts using extended reality technologies for the development and critique of XR projects. Includes planning and design of the final work. Students use multiple ideation methods to develop project ideas and work in critical groups to strengthen project ideas and then prototype. Requires the completion of a project and presentation of the work.

**EXRE 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**EXRE 7500. Extended Realities (XR) Project. (4 Hours)**

Offers students an opportunity to focus on the creation of extended reality experiences. Includes planning and design of the experiences. Discusses and reflects on the design process at the crossroads of methodological, systematic iteration, and creative exploration.

**Prerequisite(s):** EXRE 5010 with a minimum grade of C-

**EXRE 7990. Thesis. (4 Hours)**

Offers students support in developing and producing the written component of an extended reality thesis that integrates and applies their accumulated knowledge. Encourages student participation within a practice and research community consisting of classmates, advisor(s), and external professionals.

**Prerequisite(s):** EXRE 5030 with a minimum grade of C-

## Finance - CPS (FIN)

### **FIN 1200. Managing Your Personal Finances. (3 Hours)**

Introduces the practical finance skills that enable students to identify their personal financial goals—such as budgeting, saving and investing, borrowing, retirement, home buying, insurance needs, and estate planning—with their careers and incomes. Offers students an opportunity to plan and make financial decisions that will help them reach those goals.

### **FIN 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **FIN 2105. Introduction to Corporate Finance. (3 Hours)**

Studies the basic theory, techniques, and application of financial analysis tools needed for business financial administration and decision making.

### **FIN 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **FIN 3100. Finance for New Ventures. (3 Hours)**

Focuses primarily on startup ventures and the methods most useful to early stages companies, including microfinance, crowdfunding, angel investing, and venture capital. Covers the financing mechanism of a startup, including nonprofit companies and social entrepreneurship ventures.

**Prerequisite(s):** ACC 2100 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

### **FIN 3310. Financial Institutions and Markets. (3 Hours)**

Explores the structure and functioning of the U.S. and international financial markets and institutions. Topics covered include banking theory; instruments of various financial markets; the roles of traditional and nontraditional financial intermediaries; and the impact of securitization, international financial competition, financial system stability, and financial regulation.

**Prerequisite(s):** FIN 2105 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

### **FIN 3330. Risk Management and Insurance. (3 Hours)**

Offers students an opportunity to develop an understanding and appreciation of fundamental insurance principles. Studies risk, risk management, rating, and contract elements. Course material includes the major lines of insurance covering both personal and commercial insurance.

**Prerequisite(s):** FIN 2105 with a minimum grade of D-

### **FIN 3340. Investments. (3 Hours)**

Studies the nature of securities, the mechanics and costs of trading, and the ways in which the securities markets operate. Applies risk-return analysis in making decisions to buy or sell stocks, bonds, options, and other investments. Requires a semester-long project in which students follow and analyze the performance of individual and a portfolio of investments with written analysis.

**Prerequisite(s):** FIN 3310 with a minimum grade of D-

### **FIN 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **FIN 4220. Working Capital Management. (3 Hours)**

Explores short-term financial management. Reviews institutional and legal aspects as a context for making decisions involving current assets and current liabilities. This working capital management—the management of cash, inventories, accounts receivable, and short-term credit arrangements by business firms—provides the basis of long-term survival of businesses.

**Prerequisite(s):** FIN 2105 with a minimum grade of D-

**FIN 4230. International Finance. (3 Hours)**

Studies the international financial environment in which organizations operate, including trade, balance of payments, capital flows, tariff policies, international economic institutions, currency, and exchange-rate issues. Explores international aspects of investment planning and financing decisions and other factors important to managing multicountry cash flows and financing of multinational corporations.

**Prerequisite(s):** FIN 3310 with a minimum grade of D-

**FIN 4240. Personal Financial Planning. (3 Hours)**

Focuses on the logic, concepts, tools, and applications of financial planning for retirement, estate planning, and financial risk management. Forecasts and analyzes various financial needs such as retirement income, health and insurance protection, dependent protection projections, etc., and utilizes investment vehicles to develop a financial plan to meet the forecast needs. Intended for those planning careers in personal financial advising in one of the various financial services environments.

**Prerequisite(s):** FIN 3330 with a minimum grade of D- ; FIN 3340 with a minimum grade of D-

**FIN 4250. Real Estate Finance. (3 Hours)**

Discusses finance concepts applied to real estate issues. Topics include mortgage instruments, mortgage markets, residential real estate closing, income property analysis, financial leverage, real estate valuation, securitization, and real estate investments.

**Prerequisite(s):** FIN 3310 with a minimum grade of D-

**FIN 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**FIN 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**FIN 6101. Accounting Fundamentals for Financial Institutions. (3 Hours)**

Emphasizes managerial and financial accounting concepts as they apply to financial institutions. Analyzes financial statements of a variety of financial institutions with an emphasis on understanding the accounting structure of financial institutions, ratio analysis as it is used to evaluate financial performance, and accounting control systems.

**FIN 6102. Asset and Liability Management. (3 Hours)**

Provides a risk-management analysis of the assets and liabilities of financial institutions. Topics include analysis and management of regulatory, liquidity, capital, credit, currency, and interest-rate risks.

**FIN 6120. Building Financial Relationships. (3 Hours)**

Explores how financial institutions develop, price, and market financial products and services in a global economy. Examines the variety of financial products available, product packaging and pricing decisions, cross-selling, and relationship building in a competitive marketplace.

**FIN 6161. Investment Analysis. (3 Hours)**

Focuses on investment management as the study of risk and return of financial securities and real assets. Explores domestic and international financial markets and the securities traded therein. Offers students an opportunity to develop an understanding of security analysis, including fundamental, technical, and quantitative techniques used in the valuation of financial assets. Analyzes qualitative concepts such as market efficiency, intrinsic value, and risk. Stresses portfolio construction, management, and protection.

**FIN 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Finance and Insurance (FINA)

### **FINA 1209. Personal Finance. (4 Hours)**

Emphasizes the development of individually focused financial information and a comprehensive financial plan designed to enable the individual to manage his or her financial affairs. Integrates personal goals—such as buying a home, retirement, investing, and insurance needs—to help assure that the financial plan incorporates the major decision stages an individual faces.

### **FINA 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **FINA 2201. Financial Management. (4 Hours)**

Designed to develop the financial skills and logical thought processes necessary to understand and discuss financial policy decisions in a global economy. Specific objectives include developing an understanding of the time value of money; using financial statements in decision making; and understanding the nature of financial markets, the cost of capital, valuation of stocks and bonds, management of short-term assets, short-term and long-term financing, capital markets, and multinational financial management. Addresses the impact of legal, social, technological, and ethical considerations on efficient economic outcomes. Requires a financial calculator and provides an opportunity to develop computer spreadsheet skills.

**Prerequisite(s):** ACCT 1201 with a minimum grade of D- or ACCT 1209 with a minimum grade of D- or ACCT 1202 with a minimum grade of D-

### **FINA 2209. Financial Management. (4 Hours)**

Does not count as credit for business majors. Counts as FINA 2201 for business minors only.

**Prerequisite(s):** ACCT 1201 with a minimum grade of D- or ACCT 1209 with a minimum grade of D- or ACCT 1202 with a minimum grade of D-

### **FINA 2720. Sustainability in the Business Environment. (4 Hours)**

Examines a variety of environmental problems, including global warming, use and disposal of toxic substances, and depletion of natural resources such as water and petroleum. Many of these problems arise because these are resources that are available to all and so their overuse is an externality that is not included in manufacturing costs. Businesses have been involved in both identifying sustainability issues in their individual organizations and providing a variety of innovative solutions. Uses a combination of readings and case analyses to assesses how both government regulations—such as taxes, subsidies, building codes, prohibitions of use—and business solutions—including zero emissions, green design, producer take-back, life cycle assessment, and corporate environmental reporting—address these problems.

### **FINA 2730. Fintech and Financial Innovation. (4 Hours)**

Offers a broad overview of the world of fintech, from the perspectives of both large financial institutions and small startups. Evaluates the financial services industry, forces at play that may lead to disruption in the industry, startups that have already succeeded in bringing about change, the technological tools that may be used to make changes, and how both startups and established firms might respond to the continued pace of change.

**Prerequisite(s):** FINA 2201 with a minimum grade of D- or FINA 2209 with a minimum grade of D- or FINA 2202 with a minimum grade of D- or IE 4512 with a minimum grade of D-

### **FINA 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **FINA 3301. Corporate Finance. (4 Hours)**

Designed to develop the skills needed to make and implement financial policy decisions in a global economy. Specific objectives include developing an understanding of financial analysis; company valuation; capital markets; cost of capital; capital asset pricing and risk management; short- and long-term financial policies; working capital management; multinational financial management; and special topics including lease financing, debt refunding, mergers and acquisitions, and bankruptcy and restructuring. Offers opportunities to consider many broader issues including the relevance of globalization; the world economy; technological advances; and legal, social, and ethical issues related to the practice of corporate finance. Stresses written and oral communication skills and teamwork. Uses cases and spreadsheets extensively.

**Prerequisite(s):** (FINA 2201 with a minimum grade of D- or FINA 2202 with a minimum grade of D- or FINA 2209 with a minimum grade of D- or IE 4512 with a minimum grade of D- )

**FINA 3303. Investments. (4 Hours)**

Focuses on investment management as the study of risk and return of financial securities and real assets. Students design and assess models that evaluate investments while recognizing the constraints of the real world. Explores domestic and international financial markets and the securities traded therein. Discusses techniques for valuation of financial assets. Analyzes qualitative concepts such as market efficiency, intrinsic value, and risk. Provides the ability to build unique valuation models to suit the particular investment alternative that students wish to scrutinize. Also stresses portfolio construction, management, and protection, as well as performance assessment. During the semester, students have an opportunity to create and manage a stock portfolio.

**Prerequisite(s):** FINA 2201 with a minimum grade of D- or FINA 2202 with a minimum grade of D- or FINA 2209 with a minimum grade of D- or IE 4512 with a minimum grade of D-

**FINA 3305. Real Estate Principles. (4 Hours)**

Presents a broad introduction to real estate. Introduces real estate theory, law, market analysis, and the fundamentals of real estate finance. Explores commercial real estate financing, property management, value creation strategies, and major historical events in property markets. Offers students an opportunity to develop the practical skills to evaluate personal and investment-oriented real estate decisions, understand the influences of macroeconomic factors, and consider urban development trends. No prior knowledge of real estate is necessary.

**Prerequisite(s):** FINA 2201 with a minimum grade of D- or FINA 2202 with a minimum grade of D- or FINA 2209 with a minimum grade of D- or IE 4512 with a minimum grade of D-

**FINA 3401. Responsible Investing. (4 Hours)**

Examines environmental, social, governance, and socially responsible investing. Focuses on responsible investing from the perspective of investors and asset managers. Reviews the history and current landscape using a quantitative approach by evaluating the potential trade-offs between returns and impact. Considers how to incorporate ESG factors into investment decisions and use data-driven approaches to assess various investment products to determine if they are meeting their stated goals.

**Prerequisite(s):** FINA 2201 with a minimum grade of D- or FINA 2202 with a minimum grade of D- or FINA 2209 with a minimum grade of D- or IE 4512 with a minimum grade of D-

**FINA 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**FINA 4101. Risk Arbitrage. (1 Hour)**

Introduces risk arbitrage, a strategy that profits from price gaps during mergers and acquisitions. Explores how to analyze deals, estimate success odds, and build portfolios with applications in a high-level programming language such as Python. Offers students an opportunity to test real-world strategies and weigh risks vs. rewards in alternative investments.

**Prerequisite(s):** CS 2000 with a minimum grade of D- or CS 2100 with a minimum grade of D- or DS 2000 with a minimum grade of D- or FINA 4335 with a minimum grade of D- ; (FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D- )

**FINA 4102. Futures Market Trading Strategies. (1 Hour)**

Introduces futures market trading strategies with applications in a high-level programming language such as Python. These trading strategies are an alternative approach to security selection and portfolio construction that offer investors returns uncorrelated to traditional stock and bond portfolios. Covers global macro trading, trend following, and carry. Includes other topics such as constructing trading strategies, exploring the effects of leverage, and incorporating strategies into a traditional portfolio.

**Prerequisite(s):** CS 2000 with a minimum grade of D- or CS 2100 with a minimum grade of D- or DS 2000 with a minimum grade of D- or FINA 4335 with a minimum grade of D- ; (FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D- )

**FINA 4103. Low-Volatility Equity Portfolios. (1 Hour)**

Introduces low-volatility investing with applications in a high-level programming language such as Python. Low-volatility investing is an approach to security selection and portfolio construction that favors low-volatility securities and portfolios. Covers the capital asset pricing model, along with more current research, illustrating that low-volatility securities outperform their risk-adjusted benchmarks. Includes other topics such as identifying low-volatility securities, constructing low-volatility portfolios, and exploring the effects of leverage.

**Prerequisite(s):** CS 2000 with a minimum grade of D- or CS 2100 with a minimum grade of D- or DS 2500 with a minimum grade of D- or FINA 4335 with a minimum grade of D- ; (FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D- )

**FINA 4104. Risk Parity Investing. (1 Hour)**

Introduces risk parity investing with applications in a high-level programming language such as Python. Risk parity is an asset allocation approach that considers the risk contribution from each asset and overall portfolio risk, which can lead to more stable portfolio returns over time. Exposes students to risk parity, with and without reallocation and leverage, and offers them an opportunity to deepen their understanding of diversification, modern portfolio theory, and asset allocation.

**Prerequisite(s):** CS 2000 with a minimum grade of D- or CS 2100 with a minimum grade of D- or DS 2000 with a minimum grade of D- or FINA 4335 with a minimum grade of D- ; (FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D- )

**FINA 4219. Portfolio Management. (4 Hours)**

Studies the characteristics and formation of optimal portfolios by investing risky assets and fixed incomes. The discussion of theories and models is associated with the application for portfolio decision making in practice. Offers students an opportunity to obtain the ability to establish appropriate client investment objectives, gather and assess information necessary for determining the investment style and the selection of the securities and, evaluate the performance of a portfolio. Portfolio management is a critical functionality that is provided by financial institutions such as investment banks, insurance companies, and funds. This full-semester course is designed to introduce industry-grade portfolio analysis, exploring all aspects of investment evaluation from the perspective of institutional and individual investors.

**Prerequisite(s):** FINA 3303 with a minimum grade of D-

**FINA 4220. Behavioral Finance. (4 Hours)**

Designed to revisit neoclassical economic theory based on rational market participants, then introduce students to the theory and evidence regarding psychological heuristics and biases that are inconsistent with the underlying assumptions of these classical models. Behavioral biases can severely influence financial decision making in the investment and the corporate environments, and it is important for students to understand how and why these biases occur. The course material, born out of the fields of cognitive psychology and behavioral economics, is designed to help students understand their own biases in making personal financial decisions.

**Prerequisite(s):** FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D-

**FINA 4310. Working Capital Management. (4 Hours)**

Examines strategies and analytical approaches to managing current assets and current liabilities. Explores corporate cash management under changing money market conditions. Discusses the use of interest rate futures and working capital management in a multinational context. Provides a summary overview of entrepreneurial finance, with a focus on small businesses, corporate ventures, and intrapreneurship. Applies knowledge of corporate finance in the context of starting, acquiring, managing, and divesting a business or a business unit within a corporation. Topics include analyzing the financial needs of new ventures, exploring sources of financing, managing decline, determining valuation, and reviewing exit strategies.

**Prerequisite(s):** FINA 2201 with a minimum grade of D- or FINA 2202 with a minimum grade of D- or FINA 2209 with a minimum grade of D- or IE 4512 with a minimum grade of D-

**FINA 4320. International Financial Management. (4 Hours)**

Introduces international financial markets including balance of payments, history of the international monetary system, exchange-rate determination, foreign-exchange-exposure hedging strategies, and international capital markets. Examines how the financial strategies and policies of multinational corporations differ from domestic corporations and how financial management is utilized in an international setting to achieve corporate goals.

**Prerequisite(s):** FINA 2201 with a minimum grade of D- or FINA 2202 with a minimum grade of D- or FINA 2209 with a minimum grade of D- or IE 4512 with a minimum grade of D-

**FINA 4330. Emerging Financial Markets. (4 Hours)**

Presents essential theoretical background and practical knowledge regarding investments in emerging financial markets. Covers how emerging markets are developed and how securities are valued and traded. Explores the major risk factors associated with investing in these markets as long as the basic institutional policy issues affect emerging markets. Finally, offers a practical approach to investing in emerging financial markets (including financial securities selections, analysis, and portfolio diversification).

**Prerequisite(s):** FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D-

**FINA 4335. Computational Methods and Their Applications in Finance. (4 Hours)**

Introduces Python and its data-oriented library ecosystem (NumPy, Pandas, Matplotlib, Statsmodels, SciPy, etc.). Python is one of the most widely used open-source, cross-platform programming languages. Focuses on developing a strong foundation for working with financial data in Python and implementing various financial models.

**Prerequisite(s):** FINA 3301 (may be taken concurrently) with a minimum grade of D- or FINA 3303 (may be taken concurrently) with a minimum grade of D-

**FINA 4340. Blockchain Applications in Finance. (4 Hours)**

Introduces the fundamental concepts and an overview of the blockchain and cryptocurrency space. Offers a background in fundamental concepts in blockchain technology and functionality. Explores the basics of how blockchains record and verify information, including the related definitions and terminology. Provides an in-depth overview of blockchain applications in finance. Concludes by examining the legal and regulatory framework, along with potential risks and hurdles faced by blockchain technologies.

**Prerequisite(s):** ((CS 2000 with a minimum grade of D- or CS 2100 with a minimum grade of D- or CS 2500 with a minimum grade of D- or DS 2000 with a minimum grade of D- or DS 2500 with a minimum grade of D- or EECE 2560 with a minimum grade of D- ); (FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D-)) or (FINA 4335 with a minimum grade of D- or FINA 4380 with a minimum grade of D- )

**FINA 4350. Applied Financial Econometrics and Data Modeling. (4 Hours)**

Examines how to understand and analyze data using a set of analytical tools in financial econometrics. Emphasizes time-series financial data and financial modeling. The course uses programming languages, such as Python, that are standard in fintech applications.

**Prerequisite(s):** ((CS 2000 with a minimum grade of D- or CS 2100 with a minimum grade of D- or CS 2500 with a minimum grade of D- or DS 2500 with a minimum grade of D- or EECE 2560 with a minimum grade of D- or DS 2000 with a minimum grade of D- ); (FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D-)) or (FINA 4335 with a minimum grade of D- or FINA 4380 with a minimum grade of D- )

**FINA 4370. Financial Modeling. (4 Hours)**

Designed to develop students' quantitative financial modeling skills and techniques using the Excel spreadsheet. Through learning how to use numerical examples and business cases, students study corporate valuation, weighted average cost of capital (WACC), pro forma statement modeling, portfolio models, and Monte Carlo simulation methods, etc. Seeks to cultivate students' ability to make assumptions, deal with imperfect information, and real-world data issues. Offers students an opportunity to apply theoretical knowledge in advanced corporate finance, asset pricing, and option pricing in a real-world context. This course is highly quantitative in nature; while it does not derive complicated mathematical formulas, familiarity with concepts such as the capital asset pricing model (CAPM), WACC, portfolio theory, and pro forma financial statements is expected.

**Prerequisite(s):** FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D-

**FINA 4390. Machine Learning in Finance. (4 Hours)**

Offers students an opportunity to prepare for rapid changes in the financial services world due to technological innovations and to understand how ML and AI tools are relevant in the financial services industry; to learn the basics of these tools, including machine learning; and to analyze the ethical considerations in the use of these tools in financial services. Seeks to train students to develop data analytics solutions using machine learning and deep learning models, allowing them to answer analytical questions that are encountered in the finance space. Working knowledge of Microsoft Excel or other spreadsheet programs is strongly recommended.

**Prerequisite(s):** ((CS 2000 with a minimum grade of D- or CS 2100 with a minimum grade of D- or CS 2500 with a minimum grade of D- or DS 2500 with a minimum grade of D- or EECE 2560 with a minimum grade of D- or DS 2000 with a minimum grade of D- ); (FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D-)) or (FINA 4335 with a minimum grade of D- or FINA 4380 with a minimum grade of D- )

**FINA 4410. Valuation and Value Creation. (4 Hours)**

Explores recent developments in financial management and financial analysis through the use of modern finance theory to make capital allocation decisions that lead to long-run value maximization for the corporation. Focuses on applications and financial model building. Examines risk analysis by building spreadsheet models for valuation and risk-analysis applications. Utilizes valuation analysis models to merge financial, corporate, and business strategies to measure and manage corporate value. Develops an understanding of the mechanics of the valuation process, along with an understanding of the drivers of value and development of strategies for value creation. Topics covered are relevant to value consultants, corporate managers, and securities analysts.

**Prerequisite(s):** FINA 2201 with a minimum grade of D- or FINA 2202 with a minimum grade of D- or FINA 2209 with a minimum grade of D- or IE 4512 with a minimum grade of D-

**FINA 4412. Personal Financial Planning. (4 Hours)**

Emphasizes the development of personal financial management knowledge by applying the techniques and perspectives of financial planning professionals. Builds upon and applies skills gained in FINA 2201 to personal finance decisions such as retirement planning, home mortgages, and overall risk management. Offers students an opportunity to develop their own financial plan and understand how that plan will change as they age and their life situation changes. Note that while this course is not designed to prepare students to take the Certified Financial Planner exam, many of the topics, such as retirement planning, investment and securities planning, and estate planning, are among those discussed.

**Prerequisite(s):** FINA 2201 with a minimum grade of D- or FINA 2202 with a minimum grade of D- or FINA 2209 with a minimum grade of D- or IE 4512 with a minimum grade of D-

**FINA 4420. Mergers and Acquisitions. (4 Hours)**

Offers a practical, planning-based approach to managing the mergers and acquisitions (M&A) process. Analyzes how M&As create or destroy value; commonly used takeover tactics and defenses; M&A valuation techniques; alternative deal structures; and the financial, strategic, legal, and regulatory aspects of M&As. The first section covers how and when to apply the appropriate tools and skills to successfully complete a transaction. The second section offers students an opportunity to apply what has been learned to solve real-world business problems. Discusses all major elements of the acquisition process in the context of a logical process.

**Prerequisite(s):** FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D-

**FINA 4460. Algorithmic and Robo-Trading. (4 Hours)**

Covers the basis and implementation of trading strategies commonly used by investment professionals, such as fundamental analysis, factor investing, covariance models, and high-frequency trading. Today's asset management industry increasingly incorporates the delivery and execution of investment strategies through automated algorithms. Offers students an opportunity to understand the advantages and limitations of systematic trading and execution strategies. Students apply and modify such strategies and evaluate their performance using real-time data and incorporate aspects of Big Data in their quantitative strategies. Familiarity with a programming language such as Python is expected.

**Prerequisite(s):** ((FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D-); (DS 2000 with a minimum grade of D- ; DS 2001 with a minimum grade of D- )) or (FINA 4335 with a minimum grade of D- or FINA 4380 with a minimum grade of D- )

**FINA 4512. Financial Risk Management. (4 Hours)**

Explores the concepts of financial futures, options on financial futures, and listed options markets as developed to help corporations and financial institutions manage financial risk. Covers financial derivatives and standard hedging techniques first, followed by a study of market risk and strategies in managing market risk.

**Prerequisite(s):** FINA 3303 with a minimum grade of D- or FINA 3301 with a minimum grade of D-

**FINA 4514. Investment Banking. (4 Hours)**

Examines the investment banking business. Investment bankers are one of the most important conduits through which funds flow from savers to corporations needing to invest in plant and equipment. Offers an opportunity to examine the major functions of large investment banks in regard to their investment banking, market making, and asset management businesses; to determine the financing needs of domestic and international corporations, not-for-profit organizations, and government entities by using concepts learned in earlier courses; and to learn to link these financing needs with products that are available in the capital markets, usually through the investment banking houses.

**Prerequisite(s):** FINA 3303 with a minimum grade of D- or FINA 3301 with a minimum grade of D-

**FINA 4516. Real Estate Finance. (4 Hours)**

Surveys the field of real estate including principles of real estate law, transactions brokerage, management, development, valuation, taxation, finance, and investment. Provides a framework of real estate finance and investment, in both theory and practice. Examines all aspects of real estate financing including the primary and secondary mortgage markets, real estate financial institutions, regulations, and mortgage-backed securities. Analyzes the return, risk, and various strategies in real estate investments with financial methods and techniques. Uses case discussions, spreadsheet analysis, and investment projects to make learning effective.

**Prerequisite(s):** FINA 3303 with a minimum grade of D- or FINA 3301 with a minimum grade of D-

**FINA 4524. Credit Analysis. (4 Hours)**

Explores all aspects of credit evaluation from the perspective of banks and other institutions. Introduces industry-grade credit analysis. Credit analysis is used by all manner of banks and other institutions, such as insurance companies, hedge funds, private equity groups, and even elements of local, state, and federal governments, to evaluate clients and potential borrowers who need loans and other structured debt products.

**Prerequisite(s):** FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D-

**FINA 4526. Core Topics in Alternative Investments. (4 Hours)**

Covers alternative investments, including real assets such as real estate and real estate investment trusts, hedge funds, commodities, private equity, and structured products. This course is highly quantitative and focuses on methods for understanding risk, return, and benchmarking of these investments. Offers students an opportunity to obtain a deeper understanding of each of these asset types.

**Prerequisite(s):** FINA 3303 with a minimum grade of D- or FINA 3301 with a minimum grade of D-

**FINA 4602. Turnaround Management. (4 Hours)**

Examines strategies for identifying companies likely to fail and selecting and implementing remedial actions. Topics include business turnarounds, troubled companies, workouts, bankruptcies, and liquidations, using case studies and readings. Students evaluate a turnaround plan.

**Prerequisite(s):** FINA 2201 with a minimum grade of D- or FINA 2202 with a minimum grade of D- or FINA 2209 with a minimum grade of D- or IE 4512 with a minimum grade of D-

**FINA 4604. Fixed-Income Securities. (4 Hours)**

Exposees students to the theory, application, and evidence concerning highly sensitive interest rate products. Explores recent developments in pension fund management, asset/liability management, duration matching, "gap" management, and other important issues confronting domestic and international financial and corporate management. Offers students the opportunity to learn how to customize a risk management program.

**Prerequisite(s):** FINA 3303 with a minimum grade of D- or FINA 3301 with a minimum grade of D-

**FINA 4605. Fintech Experiential Project. (4 Hours)**

Offers students an opportunity to integrate the skills developed through their previous fintech coursework to propose, design, and implement a technology solution, either individually or in teams, to address a business problem. Either students or industry partners identify and define the business problem. The main objective of this experiential course is to develop and enhance students' problem-solving and hands-on skills, leading to a deliverable project that includes proof of concept, a prototype, and/or a final paper/presentation that demonstrates a deep understanding of the subject. Students formally present their project to the faculty member and/or industry partner with whom they are collaborating. Registration is contingent on a research proposal and approval by one of the supervising instructors.

**Prerequisite(s):** FINA 4340 with a minimum grade of D- or FINA 4350 with a minimum grade of D- or FINA 4390 with a minimum grade of D-

**FINA 4610. Entrepreneurial Finance and Private Equity. (4 Hours)**

Covers qualitative and quantitative aspects of entrepreneurial finance, such as venture capital and angel financing. Also covers private equity (i.e., buyout/leveraged-buyout firms), but in less detail. Introduces valuation in entrepreneurial finance, including valuation of startups, using real options to value innovation-intensive firms, valuation in staged financing, etc. Casedwork emphasizes the practical aspects of qualitative and quantitative issues related to venture capital financing, entrepreneurship, and innovation from the perspective of the financier and the startup firm. Discusses issues related to the venture capital industry, such as the limited partnership structure, term-sheets and contracts, exit of portfolio firms, and international investments. Requires a working knowledge of Excel or other spreadsheet programs.

**Prerequisite(s):** FINA 2201 with a minimum grade of D- or FINA 2202 with a minimum grade of D- or FINA 2209 with a minimum grade of D- or IE 4512 with a minimum grade of D-

**FINA 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated without limit.

**FINA 4983. Special Topics in Finance. (4 Hours)**

Examines areas of current interest and special topics in finance. Employs a mix of lectures, cases, and projects. Topics depend on the instructor. May be repeated up to two times.

**Prerequisite(s):** FINA 3301 with a minimum grade of D- or FINA 3303 with a minimum grade of D-

**FINA 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**FINA 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of faculty members of the department on a chosen topic. Course content depends on instructor. May be repeated up to three times for a maximum of 8 semester hours.

**FINA 6200. Value Creation through Financial Decision Making. (3 Hours)**

Highlights the role of financial management as a source of value creation in a competitive global environment characterized by rapid technological, personal, and market changes. Offers students an opportunity to develop tools and techniques of financial analysis and valuation to support financial decision making. Presents future managers with actual business problems to learn to apply the tools of financial analysis to strategic decisions faced by the firm, such as capital budgeting and capital structure.

**Prerequisite(s):** ACCT 6201 (may be taken concurrently) with a minimum grade of C- ; MGSC 6200 with a minimum grade of C-

**FINA 6202. Analysis of Financial Institutions and Markets. (3 Hours)**

Introduces the domestic and international financial system and the institutions within it. Develops data and quantitative analysis tools utilized for economic and financial modeling and analysis. Emphasis is on regression analysis and its application, including how to build and interpret statistical models. Topics include the major types of financial institutions that operate within the global economy and the financial instruments employed by them; how exchange rates, interest rates, and security prices are determined and how they affect the global economy; and how governments and central banks impact economic and financial conditions.

**FINA 6203. Investment Analysis. (3 Hours)**

Familiarizes students with domestic and international financial markets and the securities traded therein. Discusses a variety of techniques for valuation of financial assets and relies heavily on quantitative methods. Critically analyzes such qualitative concepts as market efficiency, intrinsic value, and risk. The contents of this course, descriptive, theoretical, and applied, should provide students with the ability to build unique valuation models to suit the particular investment alternative they wish to scrutinize. Also provides students with an understanding of how investment theory and investment practice relate.

**Prerequisite(s):** FINA 6200 with a minimum grade of C- or FINA 6201 with a minimum grade of C- or FINA 6208 with a minimum grade of C- or (FINA 6318 with a minimum grade of C- ; FINA 6320 (may be taken concurrently) with a minimum grade of C- )

**FINA 6204. International Financial Management. (3 Hours)**

Develops specific concepts, policies, and techniques for the financial management of the multinational firm. Topics include operation of the foreign exchange markets, foreign exchange risk management, sources and instruments of international financing, foreign direct investment and the management of political risk, multinational capital budgeting, and financing control systems for the multinational firm.

**Prerequisite(s):** FINA 6200 with a minimum grade of C- or FINA 6201 with a minimum grade of C- or FINA 6203 with a minimum grade of C- or FINA 6208 with a minimum grade of C- or (FINA 6318 with a minimum grade of C- ; FINA 6320 (may be taken concurrently) with a minimum grade of C- )

**FINA 6205. Financial Strategy. (3 Hours)**

Develops financial, analytical, and communication skills necessary to develop and implement a financial strategy consistent with firm value creation in a dynamic environment. Stresses the impact of ethical and legal considerations, global markets, and technological innovation on efficient economic outcomes. Emphasizes written and oral communication skills. Upon completion of this course, students should be able to identify and analyze a firm's strategic opportunities and propose a suitable financial strategy that is consistent with firm value creation.

**Prerequisite(s):** FINA 6200 with a minimum grade of C- or FINA 6201 with a minimum grade of C- or FINA 6208 with a minimum grade of C- or FINA 6331 with a minimum grade of C- or (FINA 6318 with a minimum grade of C- ; FINA 6320 (may be taken concurrently) with a minimum grade of C- )

**FINA 6206. Finance Seminar. (3 Hours)**

Structures discussion of current topics in the finance literature. Students read and present the works of leading researchers. Topics are broad and may cover various areas of corporate finance, investments, and institutions. Students also complete an original project emphasizing current methodologies of analysis.

**Prerequisite(s):** FINA 6203 with a minimum grade of C-

**FINA 6207. Financial Modeling. (3 Hours)**

Introduces financial modeling applications in the fields of risk management, statistics applied to finance, investments, and portfolio management. Financial modeling is used for performing financial analysis facilitating business decision making in virtually any business. Excel is the most widely used electronic spreadsheet program in the world. Offers students an opportunity to develop strong Excel proficiency needed to effectively and efficiently understand and implement the quantitative aspects of financial topics covered in the various financial courses taught in the MBA and MSF programs and to learn how to use a variety of spreadsheet tools and techniques to enhance their overall analytical skill set.

**Prerequisite(s):** FINA 6200 with a minimum grade of C- or FINA 6201 with a minimum grade of C- or FINA 6208 with a minimum grade of C- or FINA 6331 with a minimum grade of C- or (FINA 6318 with a minimum grade of C- ; FINA 6320 with a minimum grade of C- )

**FINA 6211. Financial Risk Management. (3 Hours)**

Provides an overview of all of the hedging markets and hedging instruments. Explores specific hedging use of options, forwards, futures, swaps, and options on futures. Focuses on advanced financial risk management of interest rates, currency rates, equity returns, and fixed income returns. Students use readings and case problems to study when and how to use hedging instruments to alter a portfolio's risk exposure.

**Prerequisite(s):** FINA 6203 (may be taken concurrently) with a minimum grade of C-

**FINA 6212. Fixed-Income Securities and Risk. (3 Hours)**

Exposes students to theory, applications, and evidence concerning highly sensitive interest rate products. Discusses recent developments in pension fund management, asset/liability management, duration matching, "gap" management, concurrent interest rate and exchange rate management, and other important issues now confronting domestic and international financial and corporate management. Studies how to customize a risk management program.

**Prerequisite(s):** FINA 6203 (may be taken concurrently) with a minimum grade of C-

**FINA 6213. Investment Banking. (3 Hours)**

Discusses policy, strategy, and administration of financial services firms. Topics include issuance of securities, the service function within financial services, pricing a negotiated issue of common stock or competitive bid issue, and meeting capital requirements of a securities firm.

**Prerequisite(s):** FINA 6200 with a minimum grade of C- or FINA 6201 with a minimum grade of C- or FINA 6208 with a minimum grade of C- or FINA 6331 with a minimum grade of C- or (FINA 6318 with a minimum grade of C- ; FINA 6320 (may be taken concurrently) with a minimum grade of C- )

**FINA 6214. Mergers and Acquisitions. (3 Hours)**

Explores the environments that have recently given rise to a large number of corporate mergers and the business factors underlying these corporate combinations. Examines the financial, managerial, accounting, and legal factors affecting mergers. Focuses on three aspects of the merger and acquisition process: the strategic decision to acquire, the valuation decision of how much to pay, and the financing decision on how to fund the acquisition.

**Prerequisite(s):** FINA 6200 with a minimum grade of C- or FINA 6201 with a minimum grade of C- or FINA 6208 with a minimum grade of C- or FINA 6331 with a minimum grade of C- or (FINA 6318 with a minimum grade of C- ; FINA 6320 (may be taken concurrently) with a minimum grade of C- )

**FINA 6215. Business Turnarounds. (3 Hours)**

Concentrates on the diagnosis, prescription, and implementation of actions pertinent to business turnarounds, troubled companies, workouts, bankruptcies, and liquidations. Case studies and readings guide the student through the maze of financial, ethical, legal, general business, and strategic aspects of turnarounds, culminating in the student evaluating and developing a turnaround plan.

**Prerequisite(s):** FINA 6200 with a minimum grade of C- or FINA 6201 with a minimum grade of C- or FINA 6208 with a minimum grade of C- or FINA 6331 with a minimum grade of C- or (FINA 6318 with a minimum grade of C- ; FINA 6320 (may be taken concurrently) with a minimum grade of C- )

**FINA 6216. Valuation and Value Creation. (3 Hours)**

Focuses on cash-flow oriented models of the valuation of the firm. Topics include enterprise value, free cash flow, economic value added, and risk/reward analysis. Explores recent developments in financial management and financial analysis through the use of modern finance theory to make capital allocation decisions that lead to long-run value maximization for the corporation. Focuses on applications and financial model building, risk analysis for valuation applications, and business strategies to measure and manage corporate value and value creation. Topics are relevant to value consultants, corporate managers, and securities analysts.

**Prerequisite(s):** FINA 6200 with a minimum grade of C- or FINA 6201 with a minimum grade of C- or FINA 6208 with a minimum grade of C- or FINA 6331 with a minimum grade of C- or (FINA 6318 with a minimum grade of C- ; FINA 6320 (may be taken concurrently) with a minimum grade of C- )

**FINA 6217. Real Estate Finance and Investment. (3 Hours)**

Provides students with a comprehensive understanding of real estate finance. Emphasizes factors affecting real estate investment. Topics include valuation (appraisal), market analysis, development, taxation, ownership types, short-term financing, mortgage markets, and investment strategies. Designed for students interested in a general overview of real estate finance, as well as those intending to pursue a career in the real-estate field.

**Prerequisite(s):** FINA 6200 with a minimum grade of C- or FINA 6201 with a minimum grade of C- or FINA 6208 with a minimum grade of C- or (FINA 6318 with a minimum grade of C- ; FINA 6320 (may be taken concurrently) with a minimum grade of C- ) or FINA 6332 with a minimum grade of C-

**FINA 6219. Portfolio Management. (3 Hours)**

Develops portfolio construction, revision, and performance measurement. Highlights portfolio construction in an efficient capital market. Topics include risk-return analysis, the effects of diversification on risk reduction, and the costs of inflation, taxes, and transaction costs on fixed income and equity security portfolios. Examines financial models of capital asset pricing as the basis for the analysis of portfolios from the institutional investor's viewpoint.

**Prerequisite(s):** FINA 6203 (may be taken concurrently) with a minimum grade of C-

**FINA 6220. Healthcare Finance. (3 Hours)**

Implements financial management and economic principles to analyze real-world healthcare issues. Emphasizes and encourages problem solving and creative thinking through the use of texts, cases, and models of the healthcare industry. Students are exposed to financial, managerial, and risk management strategies unique to the healthcare industry.

**Prerequisite(s):** FINA 6200 with a minimum grade of C- or FINA 6201 with a minimum grade of C- or FINA 6208 with a minimum grade of C- or (FINA 6318 with a minimum grade of C- ; FINA 6320 (may be taken concurrently) with a minimum grade of C- )

**FINA 6234. Evaluating and Managing Financial Investments. (3 Hours)**

Introduces the menu of financial assets available to investors and how these assets can be combined into optimal portfolios to meet different objectives. Presents an overview of the primary asset classes, the markets in which these assets trade, and the investment companies that manage portfolios. Focuses on quantifying the rates of return and levels of risk associated with individual investments and diversified portfolios. Offers students an opportunity to develop models of asset valuation to calculate equilibrium prices for debt and equity securities. Studies how actively managed portfolios can exploit mispricing and how investors should evaluate the performance of a managed portfolio.

**FINA 6235. Exploring and Understanding Value Creation, Maintenance, and Destruction. (3 Hours)**

Examines enhanced shareholder value as the primary goal of business and how the best managers attain that goal within ethical, legal, and regulatory guidelines. Analyzes the importance of equipping managers with a comprehensive understanding of the financial landscape, encompassing the creation and utilization of reliable information and the application of robust analytical tools. Focuses on fostering critical thinking abilities. Explores value, value creation, sustainability, and measurement by examining value investing, financial analysis and forecasting, cost of capital estimation, capital budgeting, resource allocation, capital structure, and value realization via public offerings, mergers, and acquisitions. Investigates some alternative and perhaps controversial methods used to create value. Studies interesting examples of value destruction.

**FINA 6236. Risk Management with Technology. (3 Hours)**

Introduces and explores financial risk management using derivative instruments, which are contracts whose values derive from prices of underlying assets and goods such as equities, currencies, debt, and commodities. Focuses on the valuation and application of the principal derivative building blocks, including fixed-income securities, futures and forward contracts, options, and structured financial products. Covers market structure and how these products are specifically used by corporations and financial institutions for controlling financial market risks. Explores current global developments and new product innovations. Introduces some state-of-the-art technology such as large language models in financial markets.

**FINA 6237. Fintech, Financial Innovation, and Blockchain. (3 Hours)**

Offers a broad overview of the world of fintech from the perspectives of both large financial institutions and small startups. Explores the dynamic intersections of finance and technology with a deep understanding of financial innovation, fintech trends, and blockchain technology. Presents a comprehensive understanding of regulatory challenges, risks, and opportunities within the fintech landscape. Focuses on cutting-edge concepts that are shaping the financial industry. Analyzes the impact of blockchain technology, understanding its role in creating secure, transparent, and immutable financial ecosystems.

**Prerequisite(s):** FINA 6203 with a minimum grade of C-

**FINA 6238. Risk Parity Investing. (1 Hour)**

Introduces risk parity investing with applications in a high-level programming language such as Python. Risk parity is an asset allocation approach that considers the risk contribution from each asset and overall portfolio risk, which can lead to more stable portfolio returns over time. Exposes students to risk parity, with and without reallocation and leverage, and offers them an opportunity to deepen their understanding of diversification, modern portfolio theory, and asset allocation.

**Prerequisite(s):** FINA 6203 with a minimum grade of C- ; FINA 6333 with a minimum grade of C-

**FINA 6239. Low-Volatility Equity Portfolios. (1 Hour)**

Introduces low-volatility investing with applications in a high-level programming language. Low-volatility investing is an approach to security selection and portfolio construction that favors low-volatility securities and portfolios. Covers the capital asset pricing model, along with more current research, illustrating that low-volatility securities outperform their risk-adjusted benchmarks. Includes other topics such as identifying low-volatility securities, constructing low-volatility portfolios, and exploring the effects of leverage.

**Prerequisite(s):** FINA 6203 with a minimum grade of C- ; FINA 6333 with a minimum grade of C-

**FINA 6240. Portfolio Construction and Management. (1 Hour)**

Introduces portfolio construction, management, and reporting with applications in a high-level programming language such as Python, focusing on low-volatility and risk parity investing styles. Students complete two miniprojects that involve position sizing, portfolio rebalancing, stress testing, risk limits, and portfolio reporting.

**Prerequisite(s):** FINA 6203 with a minimum grade of C- ; FINA 6333 with a minimum grade of C-

**FINA 6284. Financing Innovation and Growth. (3 Hours)**

Offers an immersion in corporate finance with a specific focus on the financing of innovation and growth at firms. Topics include analyzing and applying finance from the perspective of intrapreneurship as well as entrepreneurship.

**FINA 6292. Advanced Topics in Finance. (3 Hours)**

Examines current, specialized, and advanced topics in the areas of corporate finance, investments, risk management, valuation, private equity, venture capital, and other areas as appropriate. Course content, pedagogy, and prerequisites vary by topic and instructor. May be repeated once.

**FINA 6309. Foundations of Accounting and Finance. (3,4 Hours)**

Explores key principles of accounting, as presented in the principal financial statements. Using those principles, explores a number of accounting practices and issues. Develops tools of financial analysis and financial planning and applies the information gained to business decision making. Utilizing the principle of time value of money to compare inflows and outflows of funds occurring at different times, develops basic decision tools for managers to make sound financial choices and to understand the context in which they are made. At the end of the course, the successful student should have a sound basic understanding of accounting and financial matters and the ability to understand business decisions in context and to evaluate the choices that management faces in the normal course of business development.

**FINA 6318. Financial Management. (2 Hours)**

Introduces time value of money calculations and applications. Building upon a basis in accounting, offers students an opportunity to learn how to extract relevant information from the accounting statements for use in financial calculations and ratio analysis. Also examines capital planning, including determining relevant cash flows, calculating decision measures, and making the correct decisions.

**FINA 6320. Advanced Financial Management. (3 Hours)**

Builds upon FINA 6318. Focuses on capital allocation and both equity and fixed-income markets. Covers the fundamentals of stock and bond valuation, as well as a brief review of macroeconomic concepts including the role of the Federal Reserve, growth, and inflation. Culminates with coverage of firm capital structure and the weighted average cost of capital (WACC).

**Prerequisite(s):** FINA 6318 with a minimum grade of C- or FINA 6200 with a minimum grade of C-

**FINA 6331. Corporate Finance. (3 Hours)**

Introduces the basic framework of corporate finance and financial decision making. Topics include capital budgeting; capital investment decisions; complex valuations; security issues; dividend policy; static and dynamic capital structure; real option analysis; restructuring; bankruptcy; corporate control and governance; and the legal, ethical, and regulatory environment of financial management.

**FINA 6332. Fundamentals of Financial Math and Financial Markets. (3 Hours)**

Introduces the essential fundamental mathematics needed for the study of modern finance: probability, stochastic processes, statistics, and regression analysis. Also focuses on theory and empirical evidence useful for investment decisions. Topics include financial risk factors, financial models, financial markets and equilibrium models of security prices, market efficiency, and the empirical behavior of security prices.

**FINA 6333. Data Analytics in Finance. (3 Hours)**

Introduces Python and its use as a financial data analytics tool. Python has become one of the most widely used open-source, cross-platform programming languages. Covers the basics of programming in Python and key libraries (NumPy, Pandas, Matplotlib, etc.) used in data analytics, then focuses on implementing various financial models in Python. Topics include single and multifactor portfolio models, portfolio theory and the efficient frontier, algorithmic trading, options and futures, and value at risk.

**FINA 6334. Empirical Methods in Finance. (3 Hours)**

Examines statistical methods used to analyze financial data and test financial theories. Offers students an opportunity to learn how to access various sources of financial data, design empirical tests, and apply basic programming skills to analyze the data and arrive at conclusions. Specific topics include regression analysis, time-series analysis, event study methodology, panel data analysis, and limited dependent variable models.

**FINA 6335. Derivatives and Risk Analytics. (3 Hours)**

Introduces derivative assets, financial engineering, and risk management. Explores specific hedging use of options, forwards, and futures. Focuses on the determinants of forwards, futures, options and swaps, and various exotic derivatives pricing using computer-based numerical methods in a Monte Carlo setting and in closed form using elements of stochastic calculus. Also explores risk-management strategies using positions in derivative securities, static hedging, and dynamic hedging in continuous time.

**FINA 6336. Fixed-Income Securities and Derivatives. (3 Hours)**

Exposes students to theory, applications, and evidence concerning highly sensitive interest-rate products. Designed for students seeking to develop understanding of fixed-income valuation and hedging methods and familiarity with major markets and instruments. Emphasizes tools for quantifying, hedging, and speculations. Topics include duration; convexity; approaches to modeling the yield curve; interest-rate forward; futures, swaps, and options; credit risk and credit derivative; mortgages; and securitization.

**Prerequisite(s):** (FINA 6203 with a minimum grade of C- ; FINA 6335 with a minimum grade of C- )

**FINA 6337. Computational Methods in Finance. (3 Hours)**

Studies various computational methods in finance. Analyzes market data and build trading strategies. Uses interpolation, solver, and optimization methods to calibrate discount curve and volatility surfaces to market prices. Analyzes market data and applies dimension-reduction techniques such as principal component analysis (PCA). Applies time-series analysis and PCA to implement and back test trading strategies.

**FINA 6338. Alternative Investments. (3 Hours)**

Emphasizes assets and portfolios that fall into the category of alternative investments, which includes nontraditional assets—such as structured products and other types of derivatives—and managed portfolios—such as private equity, venture capital, and hedge funds. Offers students an opportunity to obtain a fundamental understanding of the securities and products that are traded in this space. Focuses on in-depth analyses of case studies, outside speakers, focused discussions, quantitative analyses, and current developments in the industry.

**Prerequisite(s):** FINA 6203 with a minimum grade of C-

**FINA 6339. Quantitative Portfolio Management. (3 Hours)**

Offers an introduction to portfolio management with a focus on quantitative methods. Major topics include portfolio construction, revision, and performance measurement. Examines portfolio construction using constrained mean-variance optimization, as well as performance evaluation using factor models such as the Fama-French three-factor model. Additional topics include the effects of diversification on risk reduction and the costs of inflation, taxes, and transaction costs on management of fixed-income and equity security portfolios. Also covers quantitative approaches to manage specific sources of risk. Students employ historical data to construct backtests to assess the performance of various portfolio strategies.

**Prerequisite(s):** FINA 6203 (may be taken concurrently) with a minimum grade of C-

**FINA 6340. Financial Markets and Banking in the Postcrisis Era. (3 Hours)**

Examines the history and evolution of the ways banking has changed following the 2008 financial crisis. Changes impacting the banking industry include major changes in the regulatory environment, changes in market liquidity, negative interest rates, shifts in Fed monetary policy, LIBOR transition, and technological innovation (blockchain, digital currency, automation, and artificial intelligence). Analyzes the history and evolution of these changes and the impact on the financial services industry, with a specific focus on the banking sector. Discusses the management of various banking functions (risk management, governance, profitability, liquidity management, auditing, and regulation) in today's regulatory and market environment as well as the evolution of payment systems and the expected impact of technological advancements, such as blockchain and artificial intelligence, on the industry.

**Prerequisite(s):** FINA 6203 with a minimum grade of C-

**FINA 6342. Financial Data and Fintech. (3 Hours)**

Covers methods of managing data and extracting insights from real-world financial sources. Topics include extracting and organizing data from financial, geospatial and supply chain sources; financial aggregation; and reporting. Applications include current and emergent data sources employed in finance, risk-weighted assets, market and credit risk modeling, stress testing, and climate risk. Studies major sources of financial data, data visualization, and architecture. Offers hands-on instruction in tools used in the financial industry to process datasets.

**Prerequisite(s):** FINA 6203 with a minimum grade of C-

**FINA 6343. Credit Risk Management. (3 Hours)**

Introduces credit and counterparty risk-management practices in banking, corporate and commodity finance, commercial real estate, bonds, and credit derivative markets. Banking and corporate sectors face significant capital funding challenges as central banks respond to inflationary pressures. Presents a range of analytic methods used to assess risk exposures in credit portfolios, price credit products, and hedge credit risk exposure and interest-rate volatility. Covers factors driving corporate ratings and policies aimed at ensuring bank solvency. Models related to credit risk management are presented in class. Assignments employ a variety of technology tools.

**Prerequisite(s):** FINA 6203 with a minimum grade of C-

**FINA 6360. Fund Management for Analysts. (1 Hour)**

Introduces a variety of operating documents typical to an active mutual fund. Offers students an opportunity to apply lessons from investment and portfolio management classes by presenting investment recommendations to a panel and communicating with peers in a thoughtful and forceful manner. Investment decisions are made based on student analysis and recommendations that include knowledge of macroeconomic expectations, corporate financing issues, dept-repayment concerns, and employee and technological changes. May be repeated up to three times.

**FINA 6361. Fund Management for Managers. (1 Hour)**

Builds on FINA 6360. Designed to provide students further analytical knowledge, including exposure to and opportunity to perform managerial tasks related to the management and operation of mutual funds. Included in these tasks are reconsideration of the fund's investment policy statement and asset allocation plan as well as preparation of accounting statements, dealing with compliance issues, addressing ethical concerns, measuring and managing risk, and performing marketing and fund-raising activities. May be repeated up to three times.

**Prerequisite(s):** FINA 6360 with a minimum grade of C- ; (FINA 6219 (may be taken concurrently) with a minimum grade of C- or FINA 6339 (may be taken concurrently) with a minimum grade of C- )

**FINA 6403. Investment Analytics. (4 Hours)**

Familiarizes students with domestic and international financial markets and the securities traded therein. Discusses a variety of techniques for valuation of financial assets and relies heavily on quantitative methods. Critically analyzes such qualitative concepts as market efficiency, intrinsic value, and risk. Offers students an opportunity to obtain the ability to build unique valuation models to suit the particular investment alternative they wish to scrutinize, as well as to understand how investment theory and investment practice relate. Studies CAPM, APT, index, and factor models. Discusses fixed-income securities including interest rates, bond valuation, and bond immunization.

**FINA 6404. Fundamentals of International Finance. (2 Hours)**

Presents the fundamental skills and techniques needed for the financial management of multinational firms. Offers students an opportunity to develop an understanding of the challenges and opportunities facing the financial manager in a global economy. Topics include operation of the foreign exchange markets, international parity conditions, multinational capital budgeting, and sources and instruments of international financing.

**Prerequisite(s):** (FINA 6418 with a minimum grade of C- ; FINA 6420 (may be taken concurrently) with a minimum grade of C- ) or FINA 6431 with a minimum grade of C-

**FINA 6407. Financial Modeling. (2 Hours)**

Introduces financial modeling applications in the fields of financial risk management, statistics applied to finance, investments, and portfolio management. Offers students an opportunity to develop strong Excel proficiency needed to understand and implement the quantitative aspects of financial topics covered in the various courses taught in the MBA and MSF programs and to learn how to use a variety of spreadsheet tools and techniques to enhance their overall analytical skill set.

**Prerequisite(s):** FINA 6418 with a minimum grade of C- or FINA 6420 (may be taken concurrently) with a minimum grade of C-

**FINA 6410. Advanced Real Estate Financial Modeling. (2 Hours)**

Explores real estate finance and modeling, building on foundational knowledge from prior coursework. Key focus areas include advanced real estate modeling techniques, complex mortgage financing, and securitized markets. Covers topics such as discounted cash flow models, investment return profiles, cap rate analysis, commercial mortgage-backed securities, REITs, and real estate private equity funds. Emphasizes the practical application of advanced financial analysis in real estate investment.

**Prerequisite(s):** (FINA 6418 with a minimum grade of C- ; FINA 6420 (may be taken concurrently) with a minimum grade of C- ) or FINA 6432 with a minimum grade of C-

**FINA 6412. Applied Statistics for Finance. (2 Hours)**

Introduces essential statistical concepts in a financial context with a focus on bridging theory and practice. Covers a wide variety of distributions useful in financial applications. Explains important models used in time-series analysis. Offers practice using a high-level programming language to perform statistical computations using financial data.

**FINA 6413. Introduction to Game Theory. (2 Hours)**

Introduces game theory, focusing on key solution concepts such as backward induction, Nash equilibrium, and rationalizability. Covers various types of games including sequential; simultaneous; and repeated games with discrete, continuous, and mixed-strategy equilibria. Explores adverse selection, signaling, screening, risk aversion, and risk-sharing agreements.

**FINA 6414. Merger and Acquisition Strategy. (2 Hours)**

Offers a comprehensive overview of the strategic aspects of mergers and acquisitions. Surveys the motivations behind corporate combinations and the factors that drive successful MA deals. Explores the strategic decision-making process including friendly and hostile merger strategies, anti-hostile takeover strategies, merger plans, merger process, and due diligence. Examines the legal, regulatory, and antitrust considerations involved in MA transactions.

**Prerequisite(s):** (FINA 6318 with a minimum grade of C- or FINA 6420 (may be taken concurrently) with a minimum grade of C-) or FINA 6431 with a minimum grade of C-

**FINA 6416. Valuation and Value Creation. (4 Hours)**

Explores recent developments in financial management and financial analysis through the use of modern finance theory to make capital allocation decisions that lead to the creation of long-run value. Focuses on applications and spreadsheet modeling. Utilizes valuation analysis models to merge financial, corporate, and business strategies to measure and manage corporate value. Offers students an opportunity to develop an understanding of the mechanics of the valuation process, along with an understanding of the drivers of value and the development of strategies for value creation. Discusses contemporary topics, for example, environmental, social, and governance, or ESG; valuation of nontraditional assets; and valuation of digital firms. Covers issues relevant to valuation and strategy consultants, corporate managers, securities analysts, and private equity analysts.

**Prerequisite(s):** (FINA 6418 with a minimum grade of C- ; FINA 6420 (may be taken concurrently) with a minimum grade of C-) or FINA 6431 with a minimum grade of C-

**FINA 6417. Real Estate Investment. (2 Hours)**

Explores real estate principles in-depth. Focuses on risks and opportunities within the industry. Key topics include real estate market structure, investment fundamentals, valuation strategies, and mortgage financing principles. Includes U.S. and global market dynamics, legal concepts, financial modeling, and asset valuation.

**Prerequisite(s):** (FINA 6418 with a minimum grade of C- ; FINA 6420 (may be taken concurrently) with a minimum grade of C-) or FINA 6432 with a minimum grade of C-

**FINA 6421. Applied Econometrics for Finance. (2 Hours)**

Examines the financial econometric methods used to analyze financial data and test financial theories. Explores how to access various sources of financial data, design empirical tests, and apply basic programming skills to analyze the data and arrive at conclusions. Specific topics include regression analysis, time-series analysis, panel data analysis, and event study methodology.

**FINA 6423. Quantitative Methods in International Finance. (2 Hours)**

Focuses on quantitative methods and techniques for the financial management of multinational firms, built upon foundational knowledge. Topics include exchange rate determination, currency derivatives, international arbitrage, interest rate parity, managing transaction exposure, and international cash management. Offers an opportunity to explore and master the essential quantitative skills required to navigate the complex financial landscape of multinational firms.

**FINA 6424. Corporate Governance. (2 Hours)**

Examines the conflicts of interest associated with the separation of ownership and control of the corporation. Applies agency theory and practice to the issues raised and draws on seminal works in the finance and economics literature that influence the current debate in this area. Discusses legal and ethical considerations that are especially important in corporate-control issues. Uses cases to illustrate the theories discussed and data and software from the Wharton Research Data Services database to measure financial relationships related to corporate governance.

**Prerequisite(s):** FINA 6420 with a minimum grade of C- or FINA 6431 with a minimum grade of C-

**FINA 6431. Corporate Finance. (4 Hours)**

Introduces the basic framework of corporate finance and financial decision making. Topics include capital budgeting; capital investment decisions; complex valuations; security issues; dividend policy; static and dynamic capital structure; real option analysis; restructuring; bankruptcy; corporate control and governance; the legal, ethical, and regulatory environment of financial management; risk management; and mergers and acquisitions.

**FINA 6432. Fundamentals of Financial Math and Financial Markets. (4 Hours)**

Introduces the essential mathematical tools required for modern finance and their application in a high-level programming language. Emphasizes both theoretical concepts and empirical evidence crucial for informed investment decisions. Key topics include linear algebra, calculus (single and multivariable), optimization theory, probability, statistics, and stochastic processes. Empirical subjects include the present value of money, the capital asset pricing model, mean-variance optimization, asset price dynamics, and option pricing.

**FINA 6433. Fundamentals of Programming for Finance. (2 Hours)**

Introduces programming for finance and financial data analytics. Presents key concepts in programming, data structures, and data analysis with high-level programming language. Integrates data analytics libraries and tools with techniques for acquiring and combining data from different sources. Uses these tools and techniques to evaluate risk and return.

**FINA 6435. Derivatives and Risk Analysis. (4 Hours)**

Introduces and explores financial risk management using derivative instruments, which are contracts whose values derive from prices of underlying assets and goods such as equities, currencies, debt, and commodities. Derivative pricing is essentially applied mathematics and highly quantitative. Focuses on the valuation and application of the principal derivative building blocks including swaps, futures, forward, and option contracts. Covers market structure and how corporations and financial institutions use these products to control financial market risks. Examines global developments and new product innovations.

**FINA 6436. Fixed-Income Securities. (2 Hours)**

Exposes students to theory, applications, and evidence concerning interest-rate products. Designed for students seeking to understand fixed-income valuation and hedging methods and to become familiar with major markets and instruments. Analyzes the concepts of interest-rate risk and credit risk. Discusses recent developments in pension fund management, asset/liability management, duration matching, and gap management.

**FINA 6437. Fintech, Financial Innovation, and Blockchain. (4 Hours)**

Offers a broad overview of the world of fintech, from the perspectives of both large financial institutions and small startups. Evaluates the financial services industry, forces at play that may lead to disruption in the industry, startups that have already succeeded in bringing about change, the technological tools that may be used to make changes, and how both startups and established firms might respond to the continued pace of change.

**FINA 6438. Alternative Investments. (2 Hours)**

Emphasizes assets and portfolios that fall into the category of alternative investments, which includes nontraditional assets and managed portfolios such as private equity, venture capital, real assets, and hedge funds. Offers students an opportunity to obtain a fundamental understanding of the securities and products that are traded in this space. Focuses on in-depth analyses of case studies, targeted discussions, quantitative analyses, and current developments in the industry.

**FINA 6439. Quantitative Portfolio Management. (2 Hours)**

Introduces portfolio management with a focus on quantitative methods. Major topics include the construction, rebalancing, and performance measurement of active equity portfolios. Examines portfolio construction using constrained mean-variance optimization, as well as performance evaluation using multi-factor models of risk such as the Fama-French three-factor model. Additional topics include the effects of diversification on risk reduction, transaction cost management, and style attribution. Also covers quantitative approaches to manage specific sources of risk. Course is applied and MATLAB based, and students employ historical data to backtest and assess the performance of various portfolio strategies.

**Prerequisite(s):** FINA 6403 with a minimum grade of C-

**FINA 6440. Financial Markets and Banking in the Post Financial Crisis Era. (2 Hours)**

Examines the history and evolution of the ways banking has changed following the 2008 financial crisis. Includes major changes in the regulatory environment, changes in market liquidity, negative interest rates, shifts in Fed monetary policy, LIBOR transition, and technological innovation. Analyzes these changes and the impact on the financial services industry, with a specific focus on the banking sector. Discusses the management of various banking functions (risk management, governance, profitability, liquidity management, auditing, and regulation) in today's regulatory and market environment.

**Prerequisite(s):** FINA 6403 with a minimum grade of C-

**FINA 6442. Financial Data and Fintech. (2 Hours)**

Covers methods of managing data and extracting insights from real-world financial sources. Topics include extracting and organizing data from financial, geospatial, and supply chain sources; financial aggregation; and reporting. Applications include current and emergent data sources employed in finance, risk-weighted assets, market and credit risk modeling, stress testing, and climate risk. Studies major sources of financial data, data visualization, and architecture. Offers hands-on instruction in tools used in the financial industry to process datasets.#.

**Prerequisite(s):** FINA 6403 with a minimum grade of C-

**FINA 6443. Credit Risk Management. (2 Hours)**

Introduces credit and counterparty risk-management practices in banking, corporate and commodity finance, commercial real estate, bonds, and credit derivative markets. Banking and corporate sectors face significant capital funding challenges as central banks respond to inflationary pressures. Presents a range of analytic methods used to assess risk exposures in credit portfolios, price credit products, and hedge credit risk exposure and interest-rate volatility. Covers factors driving corporate ratings and policies aimed at ensuring bank solvency. Presents models related to credit risk management.

**Prerequisite(s):** FINA 6403 with a minimum grade of C-

**FINA 6450. Futures Market Trading Strategies. (1 Hour)**

Introduces futures market trading strategies with applications in a high-level programming language such as Python. These trading strategies provide an alternative approach to security selection and portfolio construction, offering investors returns that are uncorrelated to traditional stock and bond portfolios. Covers global macro trading, trend following, and carry strategies. Includes other topics such as constructing trading strategies, exploring the effects of leverage, and incorporating strategies into a traditional portfolio.

**Prerequisite(s):** FINA 6403 with a minimum grade of C- ; FINA 6433 with a minimum grade of C-

**FINA 6451. Risk Arbitrage. (1 Hour)**

Introduces risk arbitrage, a strategy that profits from price gaps during mergers and acquisitions. Explores how to analyze deals, estimate success odds, and build portfolios with applications in a high-level programming language such as Python. Offers students an opportunity to test real-world strategies and weigh risks vs. rewards in alternative investments.

**Prerequisite(s):** FINA 6203 with a minimum grade of C- or FINA 6433 with a minimum grade of C-

**FINA 6460. Fund Management for Analysts. (1 Hour)**

Introduces a variety of operating documents typical to an active mutual fund. Offers students an opportunity to apply lessons from investment and portfolio management classes by presenting investment recommendations to a panel and communicating with peers in a thoughtful and forceful manner. Investment decisions are made based on student analysis and recommendations that include knowledge of macroeconomic expectations, corporate financing issues, dept-repayment concerns, and employee and technological changes. May be repeated up to three times.

**FINA 6461. Fund Management for Managers. (1 Hour)**

Builds on FINA 6460. Offers students an opportunity to obtain further analytical knowledge, including exposure to and opportunity to perform managerial tasks related to the management and operation of mutual funds. Included in these tasks are reconsideration of the fund's investment policy statement and asset allocation plan and preparation of accounting statements, dealing with compliance issues, addressing ethical concerns, measuring and managing risk, and performing marketing and fundraising activities. May be repeated up to three times.

**Prerequisite(s):** FINA 6460 with a minimum grade of C- ; (FINA 6419 (may be taken concurrently) with a minimum grade of C- or FINA 6439 (may be taken concurrently) with a minimum grade of C- )

**FINA 6492. Advanced Topics in Finance. (2,4 Hours)**

Examines current, specialized, and advanced topics in the areas of corporate finance, investments, risk management, valuation, private equity, venture capital, and other areas as appropriate. Course content, pedagogy, and prerequisites vary by topic and instructor.

**FINA 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**FINA 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

## First-Year Seminar (FSEM)

**FSEM 1000. Connections and Decisions. (1 Hour)**

Intended for first-year students who have not yet declared a major. Designed to introduce students to the liberal arts disciplines and majors, help them develop the analytical and critical thinking skills necessary to choose a major, and provide undeclared first-year students with grounding in the culture and values of the college and the University community.

**FSEM 1101. First-Year Inquiry Seminar. (1 Hour)**

Offers students an opportunity to explore a specific area of academic research in a small-group seminar environment. Students meet regularly with a faculty member to read and discuss the faculty member's research. Research topics vary, but general themes discussed include (a) how a specific research topic emerges and evolves over time, (b) the selection and implementation of specific research methodologies, (c) the contextualization of particular research studies within broader academic and real-world conversations, and (d) how the specific research contributes to philosophical and/or practical discussions in the world in which we live. The latter may include discussing how the research findings might help answer questions and/or be used in solving problems and making decisions. May be repeated up to three times.

**FSEM 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**FSEM 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**FSEM 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**FSEM 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**FSEM 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## French (FRNH)

**FRNH 1101. Elementary French 1. (4 Hours)**

Designed for students with very little or no prior knowledge of French. Provides a lively introduction to basic oral expression, listening comprehension, and elementary reading and writing. Each lesson incorporates helpful information about daily life in France and the varied cultures within the world of French speakers. Laboratory practice complements class work, enables students to work aloud at their own speed, reinforces their acquisition of essential structures, and acquaints them with a vast library of audio-visual resources.

**FRNH 1102. Elementary French 2. (4 Hours)**

Continues FRNH 1101. Reviews and continues the study of grammar and basic language skills. Offers progressively more intensive practice in oral and written communication. Laboratory practice complements class work, enables students to work aloud at their own speed, reinforces their acquisition of essential structures, and acquaints them with a vast library of audio-visual resources.

**Prerequisite(s):** FRNH 1101 with a minimum grade of C- or FRNH 1301 with a minimum grade of C-

**FRNH 1280. French Film and Culture. (4 Hours)**

Provides an introduction to some of the qualities that have made French film one of the great national cinemas. Focuses on both form and content; relates outstanding directors' major works to the French culture and society of their period. Conducted in English.

**Attribute(s):** NUpath Interpreting Culture

**FRNH 1501. Introduction to French Culture. (4 Hours)**

Explores contemporary France and French mentality through lectures, screenings, readings, and discussions. Topics covered include the modern vs. the traditional family, social reproduction, gender norms, culture and social distinction, the concept of "grandeur," identity, and immigration. Offers students an opportunity to evaluate historical and sociological readings, films, documentaries, and TV commercials; to compare French and American systems; and to consider contemporary human and social behaviors in the face of globalization. Conducted in English.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**FRNH 1973. Special Topics in Francophone Culture. (4 Hours)**

Explores in-depth a specific topic related to Francophone culture, literature, and/or language. Taught in English. May be repeated twice.

**FRNH 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**FRNH 2101. Intermediate French 1. (4 Hours)**

Emphasizes further vocabulary building and mastery of fine points of grammar through written composition, prepared oral reports, and reading and discussion from current French periodicals.

**Prerequisite(s):** FRNH 1102 with a minimum grade of C- or FRNH 1302 with a minimum grade of C-

**FRNH 2102. Intermediate French 2. (4 Hours)**

Continues FRNH 2101. Stresses the fundamentals of French to promote effective self-expression through speaking and writing and to explore the idiomatic aspects of the language. Through progressive class discussions and oral and written commentaries, students analyze a contemporary French novel or a French cultural reader, screenplay, or collection of short stories. Strives to help students read and comprehend modern French writing with confidence, and to be able to talk and write about it in good French. Provides preparation for advanced courses.

**Prerequisite(s):** FRNH 2101 with a minimum grade of C- or FRNH 2301 with a minimum grade of C-

**FRNH 2900. Specialized Instruction in French. (1-4 Hours)**

Focuses on developing students' language proficiency and cultural competence within a specific context. May be repeated twice for a maximum of 12 semester hours with department approval.

**Prerequisite(s):** FRNH 1102 with a minimum grade of C-

**FRNH 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**FRNH 3101. Advanced French 1. (4 Hours)**

Continues further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through advanced reading, composition, grammar review, and listening skills. Whenever possible, offers students an opportunity to engage in local community activities to enhance communication skills and cultural knowledge.

**Prerequisite(s):** FRNH 2102 with a minimum grade of C- or FRNH 2302 with a minimum grade of C- or French Placement Test with a score of 411

**FRNH 3102. Advanced French 2. (4 Hours)**

Builds on FRNH 3101 and continues further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through advanced reading, composition, grammar review, and listening skills. Whenever possible, offers students an opportunity to engage in local community activities to enhance communication skills and cultural knowledge.

**Prerequisite(s):** FRNH 3101 with a minimum grade of C- or FRNH 3301 with a minimum grade of C-

**FRNH 3601. The Structure of French. (4 Hours)**

Introduces the basic principles of linguistic analysis by examining the structure of modern French. Emphasizes descriptive (and not prescriptive) analysis of the phonetic, phonological, morphological, syntactic, and semantic characteristics of modern French in its everyday use.

**Prerequisite(s):** FRNH 3101 with a minimum grade of C- or FRNH 3102 with a minimum grade of C- or FRNH 4800 with a minimum grade of C-

**FRNH 3800. Special Topics in French. (1-4 Hours)**

Focuses on specific aspects of French language and culture. May be repeated up to twice for a maximum of 12 semester hours, when topics vary.

**Prerequisite(s):** FRNH 2102 with a minimum grade of C-

**FRNH 3900. Specialized Instruction in French. (1-4 Hours)**

Focuses on developing students' language proficiency and cultural competence within a specific context. May be repeated twice for a maximum of 12 semester hours with department approval.

**Prerequisite(s):** FRNH 2102 with a minimum grade of C-

**FRNH 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**FRNH 4800. Special Topics in French. (1-4 Hours)**

Focuses on specific aspects of French language and culture. May be repeated twice for a maximum of 12 semester hours with department approval.

**Prerequisite(s):** FRNH 3102 with a minimum grade of C-

**FRNH 4810. French Pop Culture. (4 Hours)**

Focuses on contemporary French society and pop culture. Fosters a nuanced understanding of modern French cultural dynamics and perspectives through an in-depth exploration of diverse sources. Examines a wide range of topics including media, cinema, music, art, fashion, and social issues. Aims to enhance students' proficiency in French by emphasizing contextual and critical analysis, while providing a platform for developing their intercultural awareness. Conducted entirely in French.

**Prerequisite(s):** FRNH 3101 with a minimum grade of C-

**FRNH 4944. Cultural Engagement: Dialogue of Civilizations. (4 Hours)**

Engages students on-site with the culture(s) and the communities of French-speaking regions. Emphasizes the complexity, transnationalism, and interdisciplinary nature of culture(s). Employs a range of methodological approaches to describe and analyze how cultural practices, objects, texts, and meanings are created, distributed, and exchanged within particular social groups or geographic areas. Explores questions of cultural identity, meaning, representation, policy formations, and ideologies. In addition to regular in-class lectures and activities, offers students an opportunity to engage in dialogue with members of the local communities about their perspectives on relevant cultural topics and everyday experiences. May be repeated once. Conducted in French.

**Prerequisite(s):** FRNH 2101 with a minimum grade of C- or FRNH 2102 with a minimum grade of C- or FRNH 3101 with a minimum grade of C- or FRNH 3102 with a minimum grade of C- or FRNH 4800 with a minimum grade of C-

**FRNH 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**FRNH 4992. Directed Study. (1-4 Hours)**

Offers students a way of going beyond work given in the regular curriculum; may also enable students to complete major or minor requirements in certain situations. Priority is given to language majors and to juniors and seniors. May be repeated without limit.

**FRNH 5976. Directed Study. (1 Hour)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**Game Design (GAME)****GAME 1110. Games and Society. (4 Hours)**

Provides an historical and cultural perspective on games and other forms of interactive entertainment. Examines the present state and future directions of paper, card, and board games; physical games and sports; and video games. Introduces students to current issues, experiments, and directions in the field of game design. Through weekly lectures and small-group labs, students have an opportunity to develop a critical basis for analyzing game play.

**GAME 1850. Experimental Game Design. (4 Hours)**

Explores traditions of games, play, participation, and procedurality in twentieth-century art movements, including Dada, Surrealism, Fluxus, conceptual art, the Situationists, Happenings, participatory performance and Tactical Media, avant-garde music, and contemporary art games. Through readings, lectures, and studio assignments, offers students an opportunity to understand and apply key principles by creating a series of artworks using various strategies drawn from these traditions, including appropriation, scores, intervention, and expression.

**GAME 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GAME 2010. The Business of Games. (4 Hours)**

Surveys a wide array of game-specific industry topics, including pitching and development of talking points, business models and revenue structures, studio organization and style, intellectual property, contracts, project management expectations, project green-lighting, production pipelines, return on investment, outsourcing, and marketing. Exploring historical shifts and evolution of the video game market offers students an opportunity to obtain perspective on the status of the industry and potential growth in the economy.

**GAME 2355. Narrative for Games. (4 Hours)**

Offers students an opportunity to learn how contemporary narrative theories evolved and their uses in various media. Examines various mediated texts to understand how best to use storytelling strategies for students' own narrative-forward games so as to best take advantage of designing narratives for different platforms and audiences. Uses presentations and performances to enhance students' understanding of how audiences assimilate information and to critique. Students write, play, and study narrative-driven games in the context of various narrative theories and practice writing with the awareness and intention that actors and audiences will read their work and respond.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**GAME 2500. Foundations of Game Design. (4 Hours)**

Seeks to define the practice of game design within the larger context of playful interaction design, while constantly maintaining a player-centric approach. Unfolds the process of designing games between phases of analysis, synthesis, and evaluation. Establishes the role of game designer as an expert with a vision for determined player experiences and a vocal advocate for players. Seeks to offer students a broad methodology consisting of brainstorming methods, prototyping techniques, process management practices, and evaluation procedures to solve a wide array of design problems in an iterative manner.

**Attribute(s):** NUpath Creative Express/Innov

**GAME 2555. Games for Change. (4 Hours)**

Offers students sound introduction to the psychological and behavioral theories of entertainment media with the goal of implementing these theories to the future design and evaluation of games for change. Focuses more on the psychological, behavioral, and social aspects of video games than on pure technical aspects. Organized around a collection of selected readings and real-world games and discussions. The final project is based on reflective thinking, critical evaluation, and creative application.

**Attribute(s):** NUpath Creative Express/Innov

**GAME 2650. Introduction to Game Research Methods. (4 Hours)**

Surveys research methods and epistemologies relevant to game researchers, designers, and artists, including experimental studies; analytics, formal and historical analysis; ethnography; qualitative social research; and design research. Engages students in lectures, readings, and game faculty guest lectures presenting practical examples of methods discussed in the class. Seeks to familiarize students with core literatures on games, library research, and research design through a series of hypothetical research project drafts and the completion of a research project using a specific method covered in the class.

**Attribute(s):** NUpath Analyzing/Using Data

**GAME 2750. Games Criticism and Theory. (4 Hours)**

Covers fundamental theories of art, meaning-making, expression, cultural reflection, and criticism concerning media, games, and playful artifacts. Assigns several papers that offer students an opportunity to choose and apply different critical lenses to games, game criticism, and their own gameplay experience. A long-form paper allows students to train writing theoretically informed and argumentatively cogent critical presentations of games and gameplay experience.

**Prerequisite(s):** GAME 1110 (may be taken concurrently) with a minimum grade of D- or GAME 2500 (may be taken concurrently) with a minimum grade of D-

**Attribute(s):** NUpath Writing Intensive

**GAME 2755. Games and Social Justice. (4 Hours)**

Analyzes games from a social justice perspective, encouraging students to consider issues of social stereotyping, normalization, exclusion, and inequity as they apply to games from all sectors of the industry. Discusses and analyzes games using a variety of social theories from a diverse set of fields, including gender studies, critical race theory, and LGBTQ studies. Provides a studio setting in which students have an opportunity to engage in critical making of playable experiences that are based upon and deeply integrate social justice theories in their design.

**GAME 2950. Game Studio. (4 Hours)**

Offers an experiential learning course in which students collaborate with faculty on a project for credit, which may include research, game creation, or a combination of the two. Offers students an opportunity to co-produce a publishable, distributable, or exhibitable game and/or research paper, which can become part of the student's portfolio. Course may be taught by an individual faculty member or team-taught to explore a specific topic, such as documentary games, art games, physical interfaces, installations, historical games, live-action role-playing, etc. Offers students an opportunity to gain experience working on a real-world project, as well as being credited for collaboration with an established practitioner/researcher. May be repeated once.

**Prerequisite(s):** GAME 1110 with a minimum grade of D- ; GAME 2500 with a minimum grade of D- ; GAME 2650 (may be taken concurrently) with a minimum grade of D-

**GAME 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GAME 2991. Research in Game Design. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision.

**GAME 3300. Game Interface Design. (4 Hours)**

Introduces interface design for games. A game interface is the point at which the player interacts with the game system, which pertains to visual, auditory, and haptic cues; screens and graphical user interfaces; the player character; and the game controller. Analyzes successful and unsuccessful game interfaces from historical, theoretical, and cultural perspectives. Offers students an opportunity to learn to analyze, critique, and iteratively design innovative game user interfaces; learn about and practice game usability and game feel, as well as design techniques for user interfaces and user experience; and focus on designing innovative game interfaces as they iteratively develop and test a game interface from beginning to end, resulting in a portfolio-ready game interface prototype. Designed as an intermediate course for undergraduate students across disciplines.

**Prerequisite(s):** GAME 1110 with a minimum grade of D-

**GAME 3400. Level Design and Game Architecture. (4 Hours)**

Analyzes game-level designs in a variety of genres and forms. Building upon basic drawing and design skills, students have an opportunity to develop paper prototypes and simple game "mods" in the context of story and game play. Students use computer-based tools to examine game-level architecture. Encourages students to take this elective in preparation for or in parallel to the Game Projects courses.

**Prerequisite(s):** GAME 1110 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**GAME 3700. Rapid Idea Prototyping for Games. (4 Hours)**

Studies digital and nondigital prototyping techniques through weekly activities in which students build and critique prototypes around a variety of game design themes. Offers students an opportunity to build a portfolio of small proof-of-concept game prototypes over the course of the semester. Additionally, covers how to iterate on a single prototype through a semesterlong project in which students have an opportunity to work individually on a larger game design.

**Prerequisite(s):** GAME 1110 with a minimum grade of D- or GAME 2500 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**GAME 3800. Game Concept Development. (4 Hours)**

Offers student teams an opportunity to conceptualize, design, document, and develop a complete game, including content, level design, user interface, and game mechanics as specified in design documents. Offers a set of brainstorming techniques. Students segment the concepts into individual systems and prototype them in an iterative manner, formally iterating over the whole game to improve the player experience. Requires students to maintain a schedule and project management documents. Results in the presentation of the complete game for critique. May be repeated once.

**Prerequisite(s):** GAME 3700 with a minimum grade of D- ; (ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C )

**Attribute(s):** NUpath Creative Express/Innov, NUpath Writing Intensive

**GAME 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GAME 4000. Topics in Game Design. (1-4 Hours)**

Explores a variety of advanced topics in game design, including the multimedia, multidisciplinary nature of games. Taught by faculty according to their research interests and expertise.

**GAME 4155. Designing Imaginary Worlds. (4 Hours)**

Offers students an opportunity to learn to conceive, design, and convey imaginary worlds across a wide range of media. The crafting of fictional worlds has become an important skill in the media landscape, whether for video and tabletop games, comic books, novels, film, or television. Analyzes existing works in diverse genres such as fantasy, science fiction, superhero, and supernatural worlds. Explores, through creative projects, the ways in which the use of different media are suited to portray different aspects of an imaginary world.

**Attribute(s):** NUpath Creative Express/Innov

**GAME 4460. Generative Game Design. (4 Hours)**

Studies principles of procedural content generation and generative methods, including modular design, the role of randomness in design, and designing for emergence. Examines the role of generative design in games and its impact on both designers and players. Through assignments and a semester-long project, encourages student creation of generative systems for playful experiences.

**Prerequisite(s):** ARTG 2260 with a minimum grade of D- or CS 2500 with a minimum grade of D- or GAME 2500 with a minimum grade of D-

**GAME 4600. Game Production. (4 Hours)**

Focuses on the production of a substantial playable game. Students work in a team to produce a game that has been conceptualized and prototyped in a previous class. Beta testing prepares students to enter the workforce through the understanding and practice of workflows that resemble those at a professional game studio. Offers students an opportunity to develop, play-test, and iteratively refine a substantial multilevel game by creating their own goals and timelines under the guidance and supervision of the professor and then adopting individual roles and responsibilities within their team. The end result should be a fully functional group project and refined understanding of professional workflows.

**Prerequisite(s):** GAME 3700 with a minimum grade of D- or GAME 3800 with a minimum grade of D-

**GAME 4700. Game Design Capstone. (4 Hours)**

Offers students an opportunity to develop a fully functional game using the iterative design skills they develop in GAME 3700 and GAME 3800. Students take on individual roles in a large-group project, with the goal of creating a complete game from preproduction through implementation and testing. Focuses on developing, playtesting, and iteratively refining a multilevel game, in addition to class discussions and exercises oriented toward professional and portfolio development. This class is an opportunity to complete, polish, and potentially publish that project. Integrated into the capstone are opportunities for the students to gain exposure for their games and to practice their professional development skills.

**Prerequisite(s):** GAME 3700 with a minimum grade of D- ; GAME 3800 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience

**GAME 4970. Junior/Senior Honors Project 1. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**GAME 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** GAME 4970 with a minimum grade of D-

**GAME 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GAME 4992. Directed Study. (1-4 Hours)**

Provides study for the student whose unique academic needs or interests cannot adequately be satisfied in any of the scheduled courses of the department. May be repeated up to three times.

**GAME 4994. Internship. (4 Hours)**

Provides students an opportunity for internship work. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**Game Science and Design (GSND)****GSND 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GSND 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GSND 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GSND 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GSND 5110. Game Design and Analysis. (4 Hours)**

Provides theoretical background and foundation for analyzing and designing games. Examines fundamental domains that are necessary to understand what games are and how they affect players, including but not limited to interface design, level design, narrative, learning, and culture. Presents relevant concepts and frameworks from a wide variety of disciplines—psychology, phenomenology, sociology, anthropology, media studies, affect theories, learning theories, and theories of motivation—for each domain. Explains the core elements of game design, introduces students to formal abstract design tools, explores several models of design process and iteration, and offers students an opportunity to practice game design in groups.

**Corequisite(s):** GSND 5111, GSND 5112

**GSND 5111. Seminar for GSND 5110. (1 Hour)**

Offers students an opportunity to discuss and analyze selected games, applying concepts from GSND 5110. Exposes students to a varied mix of AAA and indie titles and demonstrates how to analyze and appreciate them. Open to seniors; restricted to students in selected colleges.

**Corequisite(s):** GSND 5110

**GSND 5112. Recitation for GSND 5110. (0 Hours)**

Requires students to familiarize themselves with industry-standard game development tools and to demonstrate their familiarity by developing a simple game. Participation in the recitation is integral to success in GSND 5110.

**Corequisite(s):** GSND 5110

**GSND 5122. Business Models in the Game Industry. (1 Hour)**

Examines the underlying business structure of the interactive digital entertainment industry and the characteristics of the various participants, notably developers and publishers. Seeks to deliver insight into key business models within the game industry and how the economic challenges interact. Explores the game business landscape across the industry spectrum, ranging from AAA, mobile, casual to indie development. Examines market strategies currently in practice and how they are linked with game analytics. Topics range from retail vs. online, free-to-play modes vs. pay-to-play, as well as basic monetization and distribution channels. Designed to serve as an overview of the various stakeholders in the industry and how they interact.

**GSND 5130. Mixed Research Methods for Games. (4 Hours)**

Focuses on methods and methodologies from human-computer interaction (HCI) and their use in different applications, including apps, web applications, games, and virtual worlds. Covers the basics of user-oriented evaluation, associated topics, and usability methods. Introduces the design process, usability heuristics, HCI paradigms, task models, and cognitive models. Examines quantitative and qualitative analysis of data. Offers students an opportunity to delve into experimental design, institutional review board approvals, ethics, research subject recruitment, and experiment implementations. Applies concepts through concrete projects, case examples, and exercises. Expects students to be running assignments continually and trying out different evaluation methods and methodologies.

**Corequisite(s):** GSND 5131

**GSND 5131. Recitation for GSND 5130. (0 Hours)**

Requires students to familiarize themselves with statistical analysis software and to demonstrate their ability to use the software and statistics by analyzing an existing data set retrieved from a game study. Participation in the recitation is integral to success in GSND 5130.

**Corequisite(s):** GSND 5130

**GSND 6000. Advanced Topics in Game Design. (1-4 Hours)**

Explores a variety of advanced topics in game design, including the multimedia, multidisciplinary nature of games. Taught by faculty according to their research interests and expertise.

**GSND 6001. Advanced Topics in Game Science. (1-4 Hours)**

Explores a variety of advanced topics in game science, which includes game user research, game analytics, the psychology of play, and more generally scientific methods to study and understand players and games. Taught by faculty according to their research interests and expertise. May be repeated once for a maximum of eight semester credits.

**GSND 6225. Applied Game Design. (4 Hours)**

Focuses on the design and development of applied games that effectively and ethically utilize the motivational characteristics of entertainment games to meet beneficial, nonentertainment outcomes for its players (such as serious games, gamification, games for social change, games for health, game-based learning, etc.). Studies and applies related learning and motivational theories and paradigms from larger academic fields, a selection of relevant board and digital game mechanics, salient applied game design cases, and preexisting applied game design and assessment methods. Culminates in a portfolio-building final project, during which the students apply the course materials within a simplified applied game development process.

**GSND 6240. Exploratory Concept Design. (4 Hours)**

Explores the process of designing new modalities of interaction utilizing novel uses of established technology, e.g., pervasive and affective technologies. Focuses on philosophy and practice of creating and evaluating experimental interactions. Recontextualizes gameplay concepts through permutations of basic elements such as controls, platforms, cameras, interfaces, etc. Leverages constraints as vehicles to push the boundaries of accepted design. Explores four key approaches to experimental interaction through course projects and assignments: discovering, examining, and exploring potential new technologies and interaction principles; rapidly designing and prototyping experimental interactions; pitching, justifying, and explaining designs and prototypes to others; and addressing new technologies and forms of interaction from a research perspective, focusing on their larger implications and potential impact on play.

**GSND 6250. Spatial and Temporal Design. (4 Hours)**

Explores the development and understanding of spaces used by people in 3D and 2D virtual environments. Uses an iterative process of making, criticizing, experiencing, and analyzing spatial form; compositional ideas for form making; and critical thinking. Offers students an opportunity to develop the arbitrary, yet necessary, mind-set needed to make assumptions about aesthetic spatial values and expected player behaviors. Analyzes the connection between spatial-aesthetic elements and their effects on players' psyches. Experiments with how spaces, textures, shapes, and colors can support different synchronous moods. Explores how to shape spaces that fit the rational, emotional, and behavioral profile of different types of players. Applies concepts learned from architecture and game-level design to extend students' creative and critical abilities.

**GSND 6320. Psychology of Play. (4 Hours)**

Explores theories of perception, motivation, needs, learning, goals, and belief systems as they pertain to games and play. Examines psychological principles, including visual and audio perception, emotions, behavior, personality, and the more recent scientific discoveries around psychological models explaining play behavior or motivation theories behind play. Introduces how players learn in and from games based on the relationship of play to learning theories. Forms a solid theoretical basis for a new segmentation tool—psychographics. Explores visual and cultural archetypes, digging into comics, movie sets, and cartoons to distill what makes people tick in certain ways relating to universal theories of perception and gestalt theories. Applies the theories through critical analysis of play behavior and games.

**Prerequisite(s):** GSND 5110 with a minimum grade of D- or GSND 5110 with a minimum grade of C- (Graduate)

**GSND 6330. Player Experience. (4 Hours)**

Focuses on topics of player psychology—cognition; memory; emotions; attention; and game-focused theories such as engagement, fun, user experience, player-need-satisfaction model, and flow. The development cycle of any game relies on the understanding of the players, the target market of the game product. Covers game usability engineering and game-specific evaluation methods, such as play testing, rapid iterative testing and evaluation (RITE), play-heuristic evaluation, and retrospective play reviews. Offers students an opportunity to learn how to analyze qualitative and quantitative data and to apply parametric and nonparametric statistical evaluation methods, qualitative data coding and analysis, and descriptive statistics. Requires students to apply visualization techniques of data and reporting.

**Prerequisite(s):** GSND 5130 with a minimum grade of D- or GSND 5130 with a minimum grade of C- (Graduate) or (CS 5340 with a minimum grade of C- ; CS 6350 with a minimum grade of C- )

**Corequisite(s):** GSND 6331

**GSND 6331. Recitation for GSND 6330. (0 Hours)**

Requires students to familiarize themselves with survey instruments and data visualization techniques. Participation in the recitation is integral to success in GSND 6330.

**Corequisite(s):** GSND 6330

**GSND 6340. Biometrics of Design. (4 Hours)**

Focuses on sensing methods for measuring physiological function, interpreting data from these methods and implementing them in games and designed experiences. Covers the fundamentals of sensor measurement, data quality, analysis, interpretation for user experience studies and integration for driving game mechanics. Examines quantitative data analysis and categorical decision making based on different types of biosensor data. Offers students opportunities to experience different sensing methods, integrating them into their own games, experiments, or experiences and interpreting data for a final project and use in their own future design and experimental work.

**Prerequisite(s):** GSND 5130 with a minimum grade of C-

**GSND 6350. Data-Driven Game Design. (4 Hours)**

Introduces the topic of game data science and the process of analysis with data science. Focuses on defining and understanding the player experience using game log data. Examines how gameplay data can be used to discover and communicate player behavioral patterns with the goal of supporting decision management, driving action, and/or improving game quality. Covers the fundamental tools, methods, and principles of game data science and data-driven player modeling including the knowledge-discovery process, data collection, feature extraction and selection, pattern recognition to aid in prediction and churn analysis, visualization, and reporting. Covers analytics across game forms, notably online games and delivery platforms. Presents analytical tools and visualization tools that analysts use within the game development pipeline.

**GSND 6460. Generative Game Design. (4 Hours)**

Studies principles of procedural content generation and generative methods, including modular design, the role of randomness in design, and designing for emergence. Examines the role of generative design in games and its impact on both designers and players. Through assignments and a semester-long project, encourages student creation of generative systems for playful experiences. In advanced course assignments, students are expected to evaluate the experience by applying game analytics and metrics and conducting user evaluations.

**GSND 6520. 3D Modeling and Asset Creation Principles. (4 Hours)**

Introduces the principles of 3D computer modeling and asset creation. Class lectures and demonstrations are accompanied by substantial hands-on exploration. Offers students an opportunity to gain fundamental skills for modeling, surfacing, lighting, and rendering. Projects progress from creating simple geometric objects to exploring systems for developing more complex assets, including characters and virtual environments. Topics include polygonal surface modeling tools/techniques, topology/edge flow, retopology, UV layout, surfacing/materials, lighting, physically based rendering and asset optimization for games, and real-time applications.

**GSND 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GSND 6984. Research. (1-4 Hours)**

Offers students an opportunity to conduct research under faculty supervision. May be repeated up to four times.

**GSND 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

**GSND 7980. Capstone. (4 Hours)**

Offers students an opportunity to work collaboratively on a project that showcases their game design and research skills. Projects integrate both the "science" and "design" aspects of the discipline. Students define and scope a project through appropriate research questions or hypotheses, as well as discuss the project in consideration of the preexisting literature. Presents effective project management practices for a large-scale team project. Encourages students to present and demonstrate their work at festivals, conferences, exhibitions, etc. Requires a research proposal prior to registration.

**GSND 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**GSND 7990. Thesis. (4 Hours)**

Focuses on preparing a master's thesis under faculty supervision.

**GSND 7995. Games Project. (4 Hours)**

Offers students an opportunity to obtain practical experience working on a research-driven game design project with a faculty member, resulting in a self-published game and a research paper. Involves multiple aspects of game development including level design; programming; art; audio design and project management; and game research such as research design, data analysis, and academic dissemination. Offers students regular critiques and feedback on their emerging projects. May be repeated once.

**GSND 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers continued work on the thesis project.

**Prerequisite(s):** GSND 7990 with a minimum grade of C-

**General Engineering (GE)****GE 1000. First-Year Seminar. (1 Hour)**

Seeks to support students in their transition to Northeastern and in their development as they become members of the college and university communities. Through classroom discussion and self-reflection activities, students are introduced to campus partners and opportunities, institutional policies and procedures, and academic support resources. Students are expected to attend activities that include major exploration events, diversity discussions, and student organization meetings.

**GE 1110. Engineering Design. (4 Hours)**

Seeks to develop problem-solving skills used in engineering design, using case studies for a variety of engineering disciplines. Introduces students to the use of spreadsheet tools to solve engineering problems, including data reduction and visualization of data and functions. Design topics include problem formulation and specification, creativity, evaluation tools, patents, ergonomics, system design, manufacturing, ethics in engineering, and presentation techniques. Presents engineering graphics focusing on developing 3D visualization skills and computer-aided design (CAD) application. Students develop an original design solution to a technical problem as a term project. Requires students to have a laptop computer that meets the specifications of the College of Engineering.

**Attribute(s):** NUpath Ethical Reasoning

**GE 1111. Engineering Problem Solving and Computation. (4 Hours)**

Uses a structured approach to solve engineering problems. Draws applications from a variety of engineering disciplines, which serve as a tool for introducing students to engineering analysis and design. Introduces a math application package for matrix applications and various real-life engineering problems. Includes the design of problem-solving algorithms using a high-level programming language. Topics include the use of programmable microcontrollers, as well as various electronic components.

**Attribute(s):** NUpath Formal/Quant Reasoning

**GE 1210. Scientific Revolutions Abroad. (4 Hours)**

Studies two revolutions in scientific thought—the Scientific Revolution of the seventeenth and eighteenth centuries and the computational revolution of the twentieth century. The Scientific Revolution gave scientists optimism that, in principle, they could understand everything about the world around them. In contrast, the revolutions in complexity, logic, computation, mathematics, and physics of the twentieth century put fundamental limits on what scientists could know and understand. Taught abroad, this course explores the natural connections between the history of science and scientific sites, including local museums, observatories, universities, laboratories, and archaeological sites. This material is contrasted with key results from chaos theory, computational complexity, logic, physics, quantum mechanics, and the theory of computation, all developed in the twentieth century.

**Attribute(s):** NUpath Societies/Institutions

**GE 1501. Cornerstone of Engineering 1. (4 Hours)**

Introduces students to the engineering design process and algorithmic thinking using a combination of lectures and hands-on projects and labs while encouraging critical thinking. Offers students an opportunity to develop creative problem-solving skills used in engineering design, to structure software, and to cultivate effective written and oral communication skills. Topics include the use of design and graphics communication software, spreadsheets, a high-level programming language, programmable microcontrollers as well as various electronic components, and 3-D printing. Requires students to develop an original design solution to a technical problem as a final term project. Requires students to have a laptop computer that meets the specifications of the College of Engineering.

**GE 1502. Cornerstone of Engineering 2. (4 Hours)**

Continues GE 1501 using a project-based approach under a unifying theme. Covers topics that introduce students to engineering analysis and design. Uses a math application package for matrix applications along with various real-life engineering problems solved using programming. Considers ethical reasoning in design and analysis, including ethical theories, professional codes, and emerging micro/macro issues in engineering. Introduces quantitative tools and ethical topics separately and weaves them into all design and problem-solving stages of the student projects. Covers 3-D assembly drawings and modeling, along with review and further work in design. Students work on open-ended design problems, developing working models and prototypes to demonstrate and present their designs. Requires students to have a laptop computer that meets the specifications of the College of Engineering.

**Prerequisite(s):** GE 1501 (may be taken concurrently) with a minimum grade of D-

**Attribute(s):** NUpath Ethical Reasoning

**GE 1520. Making Fundamentals in Design and Fabrication. (4 Hours)**

Utilizes numerous, accessible, low-to-medium fidelity fabrication methods used in design and fabrication prototyping. Offers students an opportunity to develop in-depth knowledge to investigate multiple manufacturing and assembly methods and learn best practices, with a goal of demonstrating the ability to choose the best technique from among the options presented. Coursework consists of individual and team-based hands-on experiences using these tools to design and build prototypes via a suite of weekly/biweekly design-build assignments. Designed for interested nonengineering students.

**GE 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GE 2310. Engineering and Technological Innovations Abroad. (4 Hours)**

Introduces students to the fundamental engineering and technological principles underlying major technical advances throughout history in a specific international context. Investigates how these significant technical innovations impacted local culture, industry, and institutions. Classroom introductory material is complemented by visits to local museums, university and government laboratories, observatories, archaeological sites, and companies. Taught in a study-abroad format.

**GE 2340. Engineering Design in a Global Context. (4 Hours)**

Presents the engineering design process, highlighting the importance of understanding and incorporating the unique resources and needs of a local context in engineering solutions with other cultures. Emphasizes practical frameworks and ways of being such as intercultural competency, empathy/design thinking, and cocreation to produce mutually beneficial solutions that meet real needs.

**Attribute(s):** NUpath Interpreting Culture

**GE 2350. Engineering Cultures. (4 Hours)**

Presents different engineering cultures around the world. Critically reflects on how people become engineers; what role they play in society; and how factors such as geography, sociopolitical landscape, and other factors influence how engineering is practiced and engineering solutions are developed.

**Attribute(s):** NUpath Societies/Institutions

**GE 2500. Design Analysis and Innovation. (4 Hours)**

Explores a customer-driven project while integrating various project management techniques, advanced computer-aided design, and microcontroller integration. Delivers course content through a series of project deliverables, design innovations and improvements, and design testing—including not only the technical performance but also commercialization potential by developing and presenting a business plan. Offers students an opportunity to manage their project using traditional and modern project management techniques, carry out a needs assessment, design a representative model, implement the model through their design, verify and validate, report on the design and modeling, and suggest improvements for a revised design and model. Design projects and topics integrate class interests to make for a customized student experience while pursuing the overall learning goals.

**Prerequisite(s):** (GE 1501 with a minimum grade of D- ; GE 1502 with a minimum grade of D- ) or (GE 1110 with a minimum grade of D- ; GE 1111 with a minimum grade of D- )

**GE 2750. Enabling Engineering. (4 Hours)**

Offers students an opportunity to develop a proposal for a design project that uses engineering technologies to improve the lives of individuals with cognitive or physical disabilities. Offers student project groups an opportunity to work with end users and caregivers at local nursing homes and special education schools to assess a specific need, research potential solutions, and develop a detailed proposal for a project. Project groups are matched with product design mentors who guide groups through the design process. Lectures cover relevant topics, including surveys of specific physical and cognitive disabilities and applicable engineering technologies. The same project may not be used to satisfy both this course and EECE 4790. May be repeated once.

**GE 2800. Engineering in Context: Critical Perspectives on Science, Technology, and Society. (4 Hours)**

Offers critical perspectives on the intertwined relationship of engineering and the social, political, and economic contexts in which engineers work. Introduces the role of engineers as their work is influenced by and impacts institutions and stakeholders at all levels of society (funding agencies, universities, publishers, research participants, technology users, and the public). Uses concepts from science and technology studies and the history of science to discuss ideas on the social and political forces that alter the landscape of science, engineering, and their intersection with medicine. Includes approaches from both traditional engineering and social scientific perspectives. Covers scientific careers and identities; statistical methods; and dynamic definitions of race, gender/sex, and disability in the context of science and engineering and social sciences.

**Attribute(s):** NUpath Societies/Institutions

**GE 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GE 2992. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**GE 3300. Energy Systems: Science, Technology, and Sustainability. (4 Hours)**

Offers students an opportunity to obtain a sound scientific, technological, and economic understanding of our modern energy system and the challenge of energy sustainability. Covers principles of energy, work, and thermodynamics; technologies from supply and demand side, including extraction of primary energy, conversion into fuels and electricity, important energy end-uses, and energy losses; fossil, nuclear power plants, and renewable energy technologies (wind, solar, wave, hydro, geothermal, biofuels); transmission and distribution for electricity and fossil fuels; energy demand by buildings, transportation, and industry, emphasizing efficient technologies; sustainability concepts, including net energy/exergy analysis and life-cycle assessment, energy-related emissions, decentralized generation, smart grids, district heating, and net-zero energy facilities.

**Prerequisite(s):** (MATH 1241 with a minimum grade of D- or MATH 1250 with a minimum grade of D- or MATH 1341 with a minimum grade of D- ); (PHYS 1151 with a minimum grade of D- or PHYS 1161 with a minimum grade of D- or PHYS 1171 with a minimum grade of D- )

**GE 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GE 4100. Engineering for Mobile Applications Abroad. (4 Hours)**

Focuses on engineering mobile applications. Topics include, but are not limited to, platform introduction, environment setup, system prototyping, project structure and resources, application life cycle, UI components, system services, sensors, security and permissions, data storage, and testing and debugging. The designed mobile application is mainly for satisfying engineering settings, such as integrating available sensor data, and interfacing with externally physical systems, such as IoT systems.

**Prerequisite(s):** GE 1111 with a minimum grade of C- or GE 1502 with a minimum grade of C- or CS 2500 with a minimum grade of C-

**Corequisite(s):** GE 4120

**GE 4120. Research in Mobile Engineering. (4 Hours)**

Focuses on guiding students working on research in the field of mobile engineering. Requires students to work as teams to identify a research problem; design and implement a new mobile application to address that problem; and submit an academic format report to summarize that work. Integrates different activities to support student learning, including a panel discussion from domain experts, visits to IT companies, and participation in cultural exchange events.

**Prerequisite(s):** CS 2500 with a minimum grade of C- or GE 1111 with a minimum grade of C- or GE 1502 with a minimum grade of C-

**Corequisite(s):** GE 4100

**GE 4892. Engineering Product Design and Prototyping Challenge Project. (4 Hours)**

Offers students an opportunity to prepare detailed engineering designs and physical prototypes of technology-based products based on real-world specifications. Projects are carried out under the umbrella of the Generate organization within the Sherman Center for Engineering Entrepreneurship Education. Project proposals are developed in collaboration with the center director, including learning outcomes, project goals, and anticipated results/products. May be repeated up to nine times.

**GE 4900. Career Management. (1 Hour)**

Provides an interactive course designed to enhance an engineering student's professional and career-related education through a series of classes taught by managers, engineers, and other professionals with industry experience. Topics include career services resources, developing skills to be an effective manager, the balance between personal and professional life, mentors, making career choices, time management vs. energy management, and others. May be repeated without limit.

**GE 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GE 4998. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**GE 5010. Customer-Driven Technical Innovation for Engineers. (4 Hours)**

Studies the role of engineering innovation in addressing customer needs in early start-ups and the need to conceive successful innovative engineering design as part of a commercialization strategy. Emphasizes understanding how engineering innovation can meet real technical market needs and how to gather the necessary, relevant technical information early in the innovation process to produce a successful engineering design. Uses a series of practical engineering design projects to demonstrate how students can assess the technical capabilities of the start-up in producing an innovative design, how to communicate with customers in an iterative engineering design process, and how to correspondingly design and innovate to meet customer technical requirements.

**GE 5020. Engineering Product Design Methodology. (4 Hours)**

Explores the iterative product development process, with a focus on user-centered design techniques. Employs generative and evaluative user research methods to set product requirements and end-user technical specifications and inform the product development decision-making process. Expects students to develop a simple product, device, or tool in a team-based workshop environment, through a project spanning opportunity recognition, concept generation, prototyping and testing, concept selection, and engineering design, all informed by the needs of the intended user population. Includes discussions of industrial design, sketching, design thinking, prototyping and manufacturing processes, and product development consulting.

**GE 5030. Iterative Product Prototyping for Engineers. (4 Hours)**

Seeks to develop in-depth knowledge and experience in prototyping by focusing on engineering processes and instrumentation that are used in different industries. Studies the prototyping cycle, from initial process flow and sketching to prototype development to testing and analysis, with an emphasis on iteration. Analyzes how different kinds of engineering prototypes can address design and user-interface needs vs. functional needs, such as looks-like and works-like prototypes. Offers students an opportunity to obtain operating knowledge of methods including 3D printing, SolidWorks, off-the-shelf hardware-software interfaces, simulation, embedded systems, product testing, prototype analysis, and prototype iteration.

**GE 5100. Product Development for Engineers. (4 Hours)**

Focuses on the main processes needed to develop a complex, high-technology product. Emphasizes the most important techniques and approaches used in a startup environment. Seeks to benefit students of all engineering disciplines including computer science and biomedical, industrial, electrical, mechanical, computer, and chemical engineering. Includes a running practical project in which a new product is designed and executed through a series of small projects for each phase of the product development process. Topics include the product life cycle, new product development processes, project planning and management, new product idea generation, the systems approach to product development, design for manufacturing, market testing and launch, and escalation to manufacturing.

**GE 7945. Master's Project. (4 Hours)**

Offers theoretical or experimental work under individual faculty supervision.

**GE 7990. Thesis. (4 Hours)**

Offers analytical and/or experimental work conducted under the auspices of the department.

**Prerequisite(s):** GE 7945 with a minimum grade of C-

**General Engineering Technology - CPS (GET)****GET 1100. Introduction to Engineering and Technology. (3 Hours)**

Analyzes the diversity, need, and applicability of engineering as the profession that solves technical problems and drives technological innovation. Discusses essential requirements to succeed academically in engineering and introduces useful tools to optimize academic performance, such as the use of computers to perform calculations and mathematics to communicate engineering ideas. Reviews simple concepts of science and mathematics in historical and quantitative context, and uses small projects and in-class demonstrations to acquaint students with engineering concepts behind common technologic innovations. Discusses basic ideas for management of projects; techniques to formulate solutions to technical problems; and general structure for engineering design, manufacturing, and testing of products.

**Attribute(s):** NUpath Natural/Designed World

**GET 1150. Foundations of Engineering Graphics and Design. (3 Hours)**

Offers students an opportunity to obtain basic engineering drafting and introductory design skills needed to function in a computer-aided drafting (CAD) environment. Covers the history of engineering hand drafting and the differences/similarities with respect to CAD tools used today. Discusses the basic steps of the engineering design process and how to apply these steps in small design projects where pictorial sketching and descriptive geometry (isometric and oblique drawings and projections) are used to communicate graphical solutions to proposed problems. Covers basic understanding of mechanical, electrical, and architectural layouts, and introduces basic dimensioning and tolerancing terms. Introduces the general features, capabilities, similarities, and differences among common engineering CAD software—such as SolidWorks, Autodesk AutoCAD, and PTC Creo—through introductory lab sessions.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Natural/Designed World

**GET 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GET 2100. Computer Engineering Programming and Analysis. (3 Hours)**

Introduces the C++ programming language. Covers basic programming constructs and manipulation of data types including arrays, strings, and pointers. Offers students an opportunity to learn to isolate and fix common errors in C++ programs, to properly allocate/de-allocate procedures, and to apply object-oriented approaches to software problems in C++. Students use data structures of arrays, stacks, lists, trees, and graphs implemented using conventional programming techniques and class libraries. Students are asked to develop and write small-scale C++ programs using the skills covered during the lectures and practices in the laboratory.

**Prerequisite(s):** MTH 2100 with a minimum grade of D- or MTH 2105 with a minimum grade of D- or MTH 2110 with a minimum grade of D- or MTH 2400 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**GET 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GET 3100. Computer Control of Manufacturing Processes. (3 Hours)**

Presents and discusses computer control of manufacturing processes. Offers students an opportunity to learn the fundamentals of manufacturing processes and automation and control technologies. Reviews hardware components such as sensors, actuators, analog-to-digital converters, and I/O devices. Demonstrates computer numeric control, industrial robotics, discrete and programmable logic controllers, and analyzes their functions, applications, advantages, and limitations. Also analyzes a variety of manufacturing systems, including automation production lines, assembly systems, and cellular and flexible manufacturing. Topics include quality control system integration and lean production.

**Prerequisite(s):** EET 3100 with a minimum grade of D-

**GET 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GET 4840. Engineering Technology Capstone Project Preparation and Proposal. (2 Hours)**

Offers students an opportunity to apply the steps of the engineering design process and develop a comprehensive written engineering project proposal. Includes a review of the engineering design process from problem statement to prototype fabrication and testing. Working closely with the instructor, students are asked to identify a technological need of actual interest for local companies, communities, or students' workplace and to follow the engineering design process. Students document the marketing, patent, and literature search for prior art, customer/engineering specifications, brainstorming process to generate feasible solutions, most viable solution selection process, and detailed labor and materials budget for actual execution of the solution to be completed in GET 4850.

**Prerequisite(s):** ENG 3105 with a minimum grade of C ; ENG 3106 with a minimum grade of S ; (AVM 4100 with a minimum grade of D- or AVM 4150 with a minimum grade of D- or MET 4100 with a minimum grade of D- )

**Attribute(s):** NUpath Writing Intensive

**GET 4850. Engineering Technology Capstone Project Execution. (4 Hours)**

Continues the design process initiated in GET 4840. Students implement the solution to the identified need/problem that they previously identified. This course is the culmination of the engineering technology academic curriculum, where students are expected to apply the knowledge and practice needed from a variety of domains in order to execute their plan of action and timeline of activities. The results of their work should culminate in the creation of an actual engineering system prototype along with a comprehensive final written report and oral presentation by team members.

**Prerequisite(s):** GET 4840 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**GET 4950. Seminar. (1-4 Hours)**

Offers an in-depth study of selected topics.

**GET 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**GET 4983. Topics. (1-4 Hours)**

Covers special topics in general engineering technology. May be repeated without limit.

**GET 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GET 4991. Research. (1-4 Hours)**

Offers students an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**GET 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic.

**GET 4994. Internship. (1-4 Hours)**

Provides students with an opportunity for internship work.

**Attribute(s):** NUpath Integration Experience

**GET 4995. Practicum. (1-4 Hours)**

Provides eligible students with an opportunity for practical experience.

**GET 4996. Experiential Education Directed Study. (1-4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major.

**Attribute(s):** NUpath Integration Experience

**Geographic Information Systems - CPS (GIS)****GIS 5103. Foundations of Geographic Information Science. (4 Hours)**

Introduces geospatial data, technology, visualization, and analysis to support spatial inquiry and decision making. Topics include geospatial principles, geospatial data models and data types, metadata and attribute data, data sources, geospatial software options, quality assurance and quality control, and government/industry application areas. Includes technical knowledge of common geospatial analysis tasks. Offers students an opportunity to obtain hands-on experience using professional-grade platforms (ArcGIS, QGIS) and other geospatial software products.

**GIS 5201. Advanced Spatial Analysis. (3 Hours)**

Provides an in-depth evaluation of theoretical, mathematical, and computational foundations of GIS. Topics include spatial information theory, database theory, mathematical models of spatial objects, and GIS-based representation. Examines advanced concepts and techniques in raster-based GIS and high-level GIS modeling techniques.

**Prerequisite(s):** GIS 5103 (may be taken concurrently) with a minimum grade of C- or GIS 5102 (may be taken concurrently) with a minimum grade of C-

**GIS 6210. Geospatial Applications. (2 Hours)**

Presents a comprehensive exploration of the various geographic information system applications. Offers students an opportunity to obtain the skills and knowledge necessary to leverage geospatial tools for data analysis, visualization, and decision making across different domains. Uses a combination of theoretical understanding and practical exercises to study how to use advanced geospatial applications to solve complex spatial problems and create meaningful solutions.

**GIS 6240. Geospatial Predictive Analytics. (2 Hours)**

Offers students an opportunity to obtain the skills and knowledge to harness the power of geospatial data for making informed predictions and decisions. Delves into the theory and practical application of predictive analytics techniques using Esri's ArcGIS Insight, a powerful tool for visualizing and analyzing spatial data. Covers data preprocessing, feature selection, model creation, evaluation, and interpretation. Applies predictive analytics techniques to geospatial data and examines how to contribute to data-driven decision making in various domains.

**GIS 6320. Use and Applications of Free and Open-Source GIS Desktop Software. (3 Hours)**

Intended to expose students to free and open source (FOSS) GIS desktop applications (primarily QGIS GRASS GIS) and implementations for them to gain an understanding of the potential benefits or drawbacks of FOSS GIS alternatives compared to proprietary standards such as ArcGIS. Focuses on practical application over GIS theory but students examine historical development of FOSS GIS as well as case studies regarding FOSS GIS utilization to aid in their understanding and appraisal of these applications. Software used: QGIS (Desktop, Browser, Print Composer, DB Manager), GRASS-GIS, Boundless Suite, PostGIS, Spatialite.

**Prerequisite(s):** (GIS 5103 with a minimum grade of C- or GIS 5102 with a minimum grade of C-); GIS 5201 with a minimum grade of C-

**GIS 6340. GIS Customization. (3 Hours)**

Provides an in-depth introduction to the customization of Esri ArcGIS using Python with hands-on experience with ArcGIS, ModelBuilder, Python, geoprocessing, and ArcPy. The focus is on automating tasks and workflows in ArcMap using ModelBuilder; applying Python programming in ArcMap and for ModelBuilder; applying practical methods of debugging, tool input parameters, and tool and code documentation. Students will create a GIS data processing tool, useful to their work or area of interest, using Python or Python and ModelBuilder. The tool must be documented and capable of gracefully handling errors. Software: ArcGIS Desktop, Notepad++, IDLE - Python IDE, other Python IDE according to student choice.

**Prerequisite(s):** GIS 5103 with a minimum grade of C- or GIS 5101 with a minimum grade of C-

**GIS 6345. Geospatial Programming. (3 Hours)**

Introduces basic concepts in computer programming for geospatial data with a focus on the Python language. Applies learned approaches to geospatial analysis and accessing Python packages for spatial data science. Examples include shapely, pandas, NumPy, matplotlib, and SciPy.

**Prerequisite(s):** GIS 5103 with a minimum grade of C- or (GIS 5101 with a minimum grade of C- ; GIS 5102 with a minimum grade of C- )

**GIS 6350. Planning a GIS Implementation. (3 Hours)**

Emphasizes the process of planning a GIS implementation so an organization ends up with the "right" GIS. GIS has the potential to benefit many different types of organizations in many different ways. Focuses on understanding the planning process and the issues involved in preparing for the implementation of a GIS within a multiuser environment. Assignments help students grasp the various stages of the process, including the understanding of organization strategy, needs assessments, capability definition, data design, system requirements, and organizational impacts. While the class uses enterprise-level GIS as the context for the planning process, the process discussed can also be applied to smaller-scale organizations and systems. This course assumes a basic understanding of GIS and basic information technology concepts. Software: N/A.

**Prerequisite(s):** GIS 5103 with a minimum grade of C- or GIS 5101 with a minimum grade of C-

**GIS 6360. Spatial Databases. (3 Hours)**

Offers students an opportunity to develop skills in acquiring and building spatial data and maintaining spatial databases. Emphasizes Personal, Workgroup, and Enterprise ArcSDE geodatabases, topology, and versioned editing. Analyzes fundamental theoretical knowledge about information systems and the unique demands created by geographic information. Material includes data modeling and knowledge representation for spatial data, database schemas and models, and architectural principles for GIS. Students use database documentation (metadata) and SQL tools to query and update database attributes. Requires a final project to create a complete geodatabase representative of a spatial database used to support a real-world application. Software: ArcGIS Desktop Advanced; ArcSDE/Microsoft SQL Server enterprise geodatabase; OSQL application to query and create data in a Microsoft SQL Server database.

**Prerequisite(s):** GIS 5103 with a minimum grade of C- or (GIS 5101 with a minimum grade of C- ; GIS 5102 with a minimum grade of C- )

**GIS 6370. Internet-Based GIS. (3 Hours)**

Introduces the basic concepts associated with publishing spatial data and serving maps on the internet. Topics covered include copyright, federal, state, and local laws about spatial data sharing; map creation with web and desktop client applications; web map coding using Open Source and proprietary APIs; publishing advanced geoprocessing services. Offers students an opportunity to create a polished web mapping application that leverages Open Source or proprietary internet GIS technologies on both server and client side. Software: Google Earth, Google Maps, ArcGIS Explorer Desktop, ArcGIS Desktop, ArcGIS Online, GeoServer, SFTP software (e.g., FileZilla, FireFTP, Cyberduck, etc.), and Carto.

**Prerequisite(s):** GIS 5103 with a minimum grade of C- or GIS 5101 with a minimum grade of C-

**GIS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GIS 6980. Capstone. (1-4 Hours)**

Offers students an opportunity to integrate their course work, knowledge, and experiences into a capstone project. Emphasizes student responsibility, development of individual competencies, and geospatial analytical techniques and methods. Learning strategies encourage self-motivation and autonomy to discover work in a supportive environment with guidance and clear expectations. The class proceeds by outlining key milestones and showing examples of deliverables to visualize the process and the desired outcomes; coaching, feedback, and guidance throughout the learning process; and structured discussions, formative assessments, and journaling via e-portfolio to elicit articulation and reflection—two key processes in effective learning. Students are expected to create a conference-ready poster, present their work orally, and assemble a showcase e-portfolio.

**Prerequisite(s):** (GIS 5103 with a minimum grade of C- or (GIS 5101 with a minimum grade of C- ; GIS 5102 with a minimum grade of C- )); GIS 5201 with a minimum grade of C- ; RMS 5105 with a minimum grade of C-

**GIS 6983. Topics. (1-4 Hours)**

Covers special topics in geographic information systems. May be repeated without limit.

**GIS 6995. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**German (GRMN)****GRMN 1101. Elementary German 1. (4 Hours)**

Designed for students with very little or no prior knowledge of German. Provides a lively introduction to basic oral expression, listening comprehension, and elementary reading and writing. Each lesson incorporates helpful information about daily life in German. Laboratory practice complements class work, enables students to work aloud at their own speed, reinforces their acquisition of essential structures, and acquaints them with a vast library of audio-visual resources.

**GRMN 1102. Elementary German 2. (4 Hours)**

Continues GRMN 1101. Includes completion of basic grammatical usage, reading of contemporary German material, and increased stress on oral and aural skills.

**Prerequisite(s):** GRMN 1101 with a minimum grade of C- or GRMN 1301 with a minimum grade of C- or German Placement Test with a score of 126

**GRMN 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GRMN 2101. Intermediate German 1. (4 Hours)**

Emphasizes further vocabulary building. Offers students an opportunity to master the fine points of grammar through written composition, prepared oral reports, and reading and discussion from contemporary German materials.

**Prerequisite(s):** GRMN 1102 with a minimum grade of C- or GRMN 1302 with a minimum grade of C- or German Placement Test with a score of 226

**GRMN 2102. Intermediate German 2. (4 Hours)**

Builds on GRMN 2101 and focuses on further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through written composition, prepared oral reports, and reading and discussion from contemporary German materials.

**Prerequisite(s):** GRMN 2101 with a minimum grade of C- or GRMN 2301 with a minimum grade of C-

**GRMN 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GRMN 3101. Advanced German 1. (4 Hours)**

Continues further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through advanced reading, composition, grammar review, and listening skills. Whenever possible, offers students an opportunity to engage in local community activities to enhance communication skills and cultural knowledge.

**Prerequisite(s):** GRMN 2102 with a minimum grade of C- or GRMN 2302 with a minimum grade of C- or German Placement Test with a score of 411

**GRMN 3102. Advanced German 2. (4 Hours)**

Builds on GRMN 3101 and continues further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through advanced reading, composition, grammar review, and listening skills. Whenever possible, offers students an opportunity to engage in local community activities to enhance communication skills and cultural knowledge.

**Prerequisite(s):** GRMN 3101 with a minimum grade of C- or GRMN 3301 with a minimum grade of C-

**GRMN 3800. Special Topics in German. (1-4 Hours)**

Focuses on specific aspects of German language and culture. May be repeated twice for a maximum of 12 semester hours, when topics vary.

**Prerequisite(s):** GRMN 2102 with a minimum grade of C-

**GRMN 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GRMN 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GRMN 4992. Directed Study. (1-4 Hours)**

Offers students a way of going beyond work given in the regular curriculum; may also enable students to complete major or minor requirements in certain situations. Priority is given to language majors and to juniors and seniors. May be repeated without limit.

**GRMN 5976. Directed Study. (1 Hour)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

## Global Studies (GBST)

### **GBST 1012. The Global Learning Experience. (1 Hour)**

Examines global citizenship in the 21st century. Introduces the concepts of global citizenship, cosmopolitanism, pluralism, and culture. Connects local issues at host sites with broader dynamics of globalization, migration, positionality, power, and privilege. Offers opportunities to analyze and apply ideas through personal reflection, application of intercultural theory, and team-based problem solving.

### **GBST 5100. Global Network Program. (20 Hours)**

Offers an opportunity to study at a global network location. May be repeated up to five times.

## Global Studies - CPS (GST)

### **GST 6100. Globalization and Global Politics and Economics. (4 Hours)**

Examines the multifaceted nature of politics and economics in an expanding global world. Analyzes the impact of globalization on political and economic systems, such as capitalism, democracy, socialism, nationalism, totalitarianism, and populism. Introduces students to the use of quantitative methods in the analysis of global relationships. Offers students an opportunity to use these tools to hypothesize the impact of future global trends on contemporary political and economic systems.

### **GST 6101. Global Literacy, Culture, and Community. (4 Hours)**

Introduces basic theories of culture, identity, and communication. Topics may include race, ethnicity, social class, gender, national identity, and religion. Explores these theories and topics through an in-depth study of a particular aspect of culture within a chosen country. Introduces students to the use of qualitative methods in the analysis of culture and communication. Offers students an opportunity to use these tools to hypothesize the impact of future global trends on contemporary cultures and identities.

### **GST 6102. Global Corporate Social Responsibility. (4 Hours)**

Examines the social responsibilities of corporations and individuals in the global 21st century. Topics include outsourcing, offshoring, international labor laws, global environmental responsibility, global human rights, global citizenship, and sustainable development. Today's global organizations understand that corporate social responsibility (CSR) must become central to their strategies in order to be truly sustainable. Explores the driving forces behind CSR, the ways that companies incorporate CSR into their growth strategies, and the risks of falling behind. Discusses how companies' views of CSR have shifted from compliance and philanthropy to efficiency and growth opportunities. Focuses on the use of qualitative and quantitative methods in the analysis of current policies and practices of multinational corporations, nation-states, and international nongovernmental organizations.

### **GST 6109. Basic Field Research Methods. (4 Hours)**

Focuses on research and analysis, which are a central part of scholarly learning. To understand the nature of how information is gathered, processed, and communicated, it is imperative that students familiarize themselves with and cultivate basic research methods used in the field of social sciences. Exposes students to the essentials of field research methods, covering various research methods as well as their applications, advantages and disadvantages, and limitations. Examines different types of studies and methods and seeks to help students prepare for field research work, effective online and library data retrieval, analyzing research data and information, and writing of a thesis paper.

### **GST 6200. The Funders. (4 Hours)**

Focuses on the financial organizations and enabling institutions of globalization. Studies the actions of the holders of financial power—"the Funders"—such as the WTO, IMF, G8, and the World Bank.

### **GST 6210. The Developers. (4 Hours)**

Focuses on the community-based groups and movements that shape popular opinion about and activism in response to living in a global world. Beginning with the social movement concept, the course examines the emergence of a global civil society that operates on a dynamic of advocacy and development mobilized by grassroots-based economic organizations and individuals.

**GST 6220. Globalization of Emerging Economies. (4 Hours)**

Examines the rising status and influence of countries categorized as “emerging economies” and whether this status is sufficient to make them a viable long-term challenge to U.S. political and economic power. Some are significant regional players. Collectively, they are seen as challenging U.S. hegemony in their region and beyond, and they have called for a larger role in global decision making for the developing world. Analyzes how these emerging economies become a potent force in the global economy and their impact on various stages of the international arena. Discussions may include a review of specific regional impacts, implications for international security, and effects on international aid policies.

**GST 6300. Security and Terrorism. (4 Hours)**

Examines the issues of security and terrorism in relation to globalization. Covers the objectives of terrorism and the implications for defining and implementing global security policy, monitoring and controlling weapons proliferation, and initiating acts of counterterrorism. Examines the impact and linkage of terrorism and security on economic development, human rights in counterterrorism, and counterintelligence activities.

**GST 6310. Immigration and Labor. (4 Hours)**

Examines the issues of immigration and labor in relation to globalization. Covers the changing role of blue- and white-collar labor in the global world and the impact of these changes on perceptions of work and labor. Explores outsourcing, offshoring, immigrant communities, citizenship, activism, and immigration in their global and historical contexts.

**GST 6320. Peace and Conflict. (4 Hours)**

Examines peace and conflict from a variety of vantage points as the two interact and emerge from intrastate violence, terrorism, and extremism.

**GST 6324. Divided Societies in the Modern World. (4 Hours)**

Analyzes the importance of culture and ethnicity in understanding conflict. Provides an overview of key concepts, ideas, and debates in the field; causes; dynamics; and policy options for resolution of social conflict using comparative international case studies.

**GST 6326. International Conflict and Cooperation. (4 Hours)**

Emphasizes conflict resolution theory, drawing upon a broad range of academic disciplines, including economics, law, sociology, psychology, anthropology, and dispute resolution, within a historical context. Provides an in-depth examination of international conflicts and approaches to peace building that enables comparisons between and among key players in international conflict and their impact on world affairs. Offers students an opportunity to prepare for further study of peace and conflict resolution in international affairs or provides transferable perspectives for a variety of professional contexts, such as nongovernmental organizations, diplomacy, teaching, media, business and law, and criminal justice.

**GST 6327. Conflict and Postconflict Development. (4 Hours)**

Focuses on causes of intrastate and interstate conflict and the role that international actors play in the process of conflict resolution and postconflict development. Presents case studies on reconciliation and confidence-building measures in societies and countries engaged in long-term conflict and how entities such as the NGOs and IGOs can hamper or facilitate resolution.

**GST 6340. The Economics of Development. (4 Hours)**

Introduces the use of economic indicators and measurements of development with reference to situations that have led to economic crises and subsequent responses by governments and institutions. Examines the predominant policy responses of rich and poor countries to the challenges of development, including issues of international assistance and recent trends in poverty reduction and participatory development. Offers students an opportunity to understand drivers for economic growth in developing and mature economies.

**GST 6350. Global Economics of Food and Agriculture. (4 Hours)**

Designed to provide students with a broad-based understanding of the global food system, while assessing its performance in terms of satisfying world food needs. Examines international dimensions of food system performance, including global trade and international aid; supply and demand trends and their implications for global food security; food and agricultural trade policies; ethics and safety regulations; and specific national food systems. Also examines specific commodity chains and their impact on economic development.

**GST 6360. Nuclear Nonproliferation. (4 Hours)**

Explores the history and development of all forms of nuclear weapons from World War II to the present. Decades after the invention of nuclear weapons, the issue of proliferation continues to occupy a significant position in both U.S. and global political discussions. Traces the history of arms control efforts; the role of science and technology; the impact of international organizations set up to monitor and regulate nuclear weapons; and the proliferation of nuclear weapons and their impact on international relations.

**GST 6430. Leadership and Management. (4 Hours)**

Examines leadership and management and the changes to both of growing global realities. Considers the evolving understanding of how leadership and management are evaluated when cross-cultural, cross-border, and increasingly complex human and economic transactions take place. Examines real-world examples of changing leadership demands and the economic realities that increasingly drive managerial innovation.

**GST 6501. Regional Studies: East Asia. (4 Hours)**

Examines regional stability and cooperation, efforts to foster democracy and human rights, and policies that have led toward increased trade and rapid economic prosperity. Explores pressures on traditional societies confronting globalization, changing roles of women, demands for improved education, along with challenges from transnational crime such as money laundering, trafficking in persons, and narcotics smuggling.

**Prerequisite(s):** GST 6100 (may be taken concurrently) with a minimum grade of C-

**GST 6502. Regional Studies: Middle East and North Africa. (4 Hours)**

Examines the Middle East from historical, sociological, political, and economic perspectives. The Middle East focus describes a range of countries extending from Morocco to Iran and includes the subregions of North Africa, the Persian Gulf, and the Arabian Peninsula. Traces the origins and ongoing efforts toward a two-state solution to the Palestinian-Israeli conflict. Explores ongoing efforts across the region for political and economic reform, the growth of civil society, and easing the strain on traditional societies in an increasingly globalized world. Studies the roots of sectarian conflicts, the problem of terrorism, and the proliferation of conventional weapons, as well as weapons of mass destruction.

**GST 6503. Regional Studies: Sub-Saharan Africa. (4 Hours)**

Explores issues in Sub-Saharan Africa surrounding democratic governance, civil society, and regional cooperation; the role of economic growth and development; efforts in conflict prevention, mitigation and resolution; challenges in the fields of health, agriculture, energy, education, and the role of women; and the problem of transnational crimes, such as narcotics smuggling, the arms trade, and trafficking in persons.

**GST 6504. Regional Studies: Europe and Eurasia. (4 Hours)**

Extends the traditional focus on Western Europe and the European Union eastward by including the blend of European and Asian cultures that has shaped the development of Russia and Central Eurasia, including Turkey, Russia, and other post-Soviet countries that form the eastern borderlands of Europe. Focuses on the persistence of historical tensions between authoritarian and democratic political cultures; the diversity of ethnic and other identities in the region; and the interconnectedness of Europe and Eurasia in policy areas such as energy, security, and immigration.

**GST 6505. Regional Studies: Southwest and Central Asia. (4 Hours)**

Focuses on countries of Central Asia as well as the subcontinent. Explores economic development, political transition, education, security, health, environmental challenges, religion, and the changing role of women in this region.

**Prerequisite(s):** GST 6100 (may be taken concurrently) with a minimum grade of C-

**GST 6506. Regional Studies: Latin America. (4 Hours)**

Covers all of Central and South America and the Caribbean. Explores economic development in the poorest regions; managing rapid growth elsewhere; and approaches to challenges including democratization, rule of law, civil society, health, narcotics, environment, and regional economic integration.

**Prerequisite(s):** GST 6100 (may be taken concurrently) with a minimum grade of C-

**GST 6540. Politics of the European Union. (4 Hours)**

Explores various political, economic, and social aspects of creation and functioning of the European Union. Introduces the politics, structure of governance, institutional design, and various policies of the European Union. Begins with a historical overview of the European integration process and surveys various theories of integration. Separate sessions cover particular topics, such as history and evolution of the EU integration, major institutions, interinstitutional dynamics of governance, and role member states. The second part of the course deals with current key policy issues, such as environment, enlargement, immigration, EU citizenship, crime prevention and terrorism, monetary union, CFSP, euroscepticism, and democratic deficit.

**GST 6550. U.S. Foreign Policy. (4 Hours)**

Examines the U.S. role in the world by focusing on the dynamics of power in the international system. Explores the theoretical foundations, historical contexts, and domestic sources of past and present U.S. foreign policy choices. Evaluates the roles of nongovernment actors. Assesses the impact of inter-agency rivalries. Case materials and topics include humanitarian intervention; the militarization of U.S. foreign policy; the global economy; tensions in the Middle East; and bilateral relations between the United States and such nations as China, Russia, Iran, as well as the European Union. Debates the efficacy and ethics of U.S. global power and the future of the U.S.-dominated liberal world order.

**GST 6560. Multilateral Diplomacy. (4 Hours)**

Studies how nations, nongovernmental organizations, multinational organizations, and other international actors advance their agendas in global and regional forums. Using an issues-based case study and applied approach, offers students an opportunity to explore how members promote diplomatic initiatives and engage in collaboration, coalition building, and negotiation within the context of multilateral organizations.

**GST 6580. Opportunities in International Consulting. (4 Hours)**

Explores international business across countries and sectors. Constitutes a first step in introducing students to concepts that cover various aspects of the private sector's role in international relations. Uses consultancy case studies and other readings.

**GST 6590. Public Diplomacy. (4 Hours)**

Examines how governments communicate directly with foreign publics for the purpose of improving image, advocating policy, and shaping public opinion. Explores radio and television broadcasting across borders, cultural programming, educational exchange programs, visitor programs, libraries and language institutes, and the impact of social media. Case studies illustrate topics such as global media and international journalism, propaganda, media in democracies and totalitarian states, media influence on foreign policy, the digital divide, intellectual property, and privacy.

**GST 6600. The Practice of Diplomacy. (4 Hours)**

Explores the practice and process of diplomacy and the work of foreign ministries, embassies, and consulates. Introduces students to representation, reporting, negotiation, intercultural contacts, and consular affairs, as well as interaction with the media, the private sector, and civil society. Offers students an opportunity to obtain a knowledge base and develop professional skills important to the diplomatic profession, including policy analysis, written and oral communication, and negotiation. Students use extensive simulations, role-playing, and case studies.

**Prerequisite(s):** GST 6100 with a minimum grade of C-

**GST 6610. Sustainable Development. (4 Hours)**

Examines the basic tools of policy analysis in the area of sustainable development. Introduces various techniques used by states, NGOs, and private corporations trying to create viable policy. These may include game theory, cost-benefit analysis, and critical mass models. Utilizes global case studies to analyze current policy and consider political viability of development programs. At the conclusion of the course, students are required to produce policy recommendations and a policy memo.

**GST 6700. Global Health Perspectives, Politics, and Experiences in International Development. (4 Hours)**

Examines the linkages between health and development that can only be understood within the broader context of sociopolitical and economic factors. Begins with the recognition that poverty plays a central role in many preventable diseases. With the development of nations have come improvements in health. In the landscape of globalization and international development, there has emerged a vast international health regime. Focuses on these linkages in the context of this international political economy of health. Examines key aspects including the concepts and architecture of global health, the global burden and epidemiology of disease, health and development of nations, and political-economic determinants of health and development. Uses a variety of analytical perspectives including political, legal, economic, and epidemiological.

**GST 6710. Critical Issues and Challenges in the Practice of Global Health. (4 Hours)**

Examines the critical issues in global health. Focuses on roles of different actors in the delivery of healthcare services, healthcare delivery systems, key initiatives and strategies to meet the burden of major diseases, planning and managing national and global health programs, emerging medical health technologies, pharmaceutical policies, marketization of healthcare, the human resources for health, etc. Begins by recognizing that, despite improvements in health across the world over the last half century, vast challenges remain for a majority of people in developing countries. Analyzes the cutting-edge issues and knowledge that are at the forefront of the global health policy agenda today. Uses a practical and policy-analytical approach with illustrative case-based analysis and extensive coverage of material.

**GST 6740. Human Rights. (4 Hours)**

Introduces students to the concept of international human rights. Focuses on the role of global, regional, and national institutions to protect human rights as well as create and enforce human rights law. Explores the role of nongovernmental organizations and the media in fact-finding and publicizing human rights violations, along with current issues and case studies.

**GST 6920. Case Study in Global Studies. (4 Hours)**

Offers an integrative, summative course for the master's degree that builds on the understanding and concepts of global studies learned throughout the program. The curriculum draws heavily upon learning outcomes and acquired skills from both the global studies core courses and advanced electives in the concentration. Throughout the course, the instructor leads students through a step-by-step process of researching and writing a well-defined project, from the initial construction of a research question through the final stages of editing and revision. Course assignments may include group projects and individual presentations. At the conclusion of the course, students should have finished a portfolio piece capable of demonstrating their application of concepts and methods learned throughout their studies.

**Prerequisite(s):** GST 6100 with a minimum grade of C- ; GST 6101 with a minimum grade of C- ; GST 6109 with a minimum grade of C- ; GST 6320 with a minimum grade of C- ; (GST 6501 with a minimum grade of C- or GST 6502 with a minimum grade of C- or GST 6503 with a minimum grade of C- or GST 6504 with a minimum grade of C- or GST 6505 with a minimum grade of C- or GST 6506 with a minimum grade of C- )

**GST 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**GST 6983. Topics. (1-4 Hours)**

Covers special topics in global studies. Topics vary by semester. May be repeated up to three times for a maximum of 12 semester hours.

**GST 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**GST 7983. Topics. (1-4 Hours)**

Covers special topics in global studies. May be repeated without limit.

**GST 7990. Thesis. (1-8 Hours)**

Offers thesis supervision by members of the department.

**Health Informatics (HINF)****HINF 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HINF 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HINF 2991. Research in Health Informatics. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated once.

**HINF 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HINF 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HINF 5101. Introduction to Health Informatics and Health Information Systems. (3 Hours)**

Introduces the history and current status of information systems in healthcare: information architectures, administrative and clinical applications, evidence-based medicine, information retrieval, decision support systems, security and confidentiality, bioinformatics, information system cycles, the electronic health record, key health information systems and standards, and medical devices. Requires enrollment in Graduate Health Informatics Program.

**HINF 5102. Data Management in Healthcare. (3 Hours)**

Explores issues of data representation in healthcare systems, including patient and provider identification, audit trails, authentication, and reconciliation. Discusses underlying design of repositories for electronic health records (EHRs) and computerized provider order entry (CPOE) systems. Includes an overview of privacy issues, legislation, regulations, and accreditation standards unique to healthcare.

**HINF 5105. The American Healthcare System. (3 Hours)**

Covers the organization, financing, and outcomes of the U.S. healthcare system. Studies opportunities and challenges to improve the cost and quality of healthcare and expand adequate coverage to all. Non-health informatics students may be able to take the course with permission of the program director.

**HINF 5106. The Canadian Healthcare System. (3 Hours)**

Presents an overview of the Canadian healthcare system. Emphasizes the current system's strengths and limitations. Uses historical context to strengthen analysis of present-day concerns. Focuses on issues of access, cost, and quality of care.

**HINF 5110. Global Health Information Management. (3 Hours)**

Studies the challenges of managing health information systems in the United States, Canada, India, China, the United Kingdom, Saudi Arabia, Singapore, Taiwan, Ghana, and Malawi. Differences in healthcare systems and national regulations make the process slightly different in each country. By exploring environments with varying degrees of regulation, students have an opportunity to think critically about the impact that a nation's environment has on health information management. Discusses case studies to encourage students to think about health informatics from a managerial perspective across private companies, government, and nongovernment organizations.

**HINF 5200. Theoretical Foundations in Personal Health Informatics. (4 Hours)**

Offers an introduction to and foundation for personal health informatics by reviewing major theories and models of health behavior change and health education at individual, interpersonal, and community levels in a wide variety of settings and populations. Health behavior change is arguably our greatest hope for reducing the burden of preventable physical and mental disease and death around the world. A thorough understanding of health behavior change theories is thus essential to developing and translating personal health interface technologies into practice and policy that can result in more powerful interventions and more robust theories. Emphasizes cultural and health disparities, global applications, advances in health communications, and the use of electronic media (e-health) and mobile media (m-health). Open to students with senior standing with permission of instructor.

**HINF 5300. Personal Health Interface Design and Development. (4 Hours)**

Explores the design of innovative personal health human-computer interface technologies. Examples include assistive technologies that aid persons with disabilities, consumer wellness promotion applications, patient education and counseling systems, interfaces for reviewing personal health records, and elder care and social network systems that monitor health and support independent living. Offers students an opportunity to work in teams to build a prototype personal health interface system to solve a real problem. Topics include needs assessment and participatory research, iterative user interface design methods for health interface development, computational sensing of health states and behavior, software architectures for iteratively testing prototype personal health interface technologies, human-computer interaction issues related to personal health technology, and technology transfer requirements to support future validation studies of technology.

**HINF 5301. Evaluating Health Technologies. (4 Hours)**

Explores the deployment and evaluation of innovative health technologies. In this project-based course, students work in teams to deploy and evaluate a health technology. Offers students an opportunity to develop a research plan to measure the effectiveness, usability, and/or feasibility of the technology; recruit study participants; deploy the technology; and analyze the data collected. Also offers students an opportunity to learn about each of these steps and work toward producing a publishable-quality research paper on the technology and results of the efficacy study, as well as to prepare a grant application that extends the technology and research methodology. Additional topics include technology transfer and implications on health policy.

**Attribute(s):** NUpath Capstone Experience

**HINF 5407. Business Application of Decision Support in Healthcare. (3 Hours)**

Explores the business of healthcare and the practical application of decision support needed to improve access to care, improve health outcomes, and reduce the cost of care. Discusses the impact of consumerism, risk-based purchasing (including ACOs), the migration from facility to home and community-based care (including medical home models), the implied broadening of the healthcare supply chain, and emerging technology trends such as blockchain.

**HINF 5976. Directed Study. (3 Hours)**

Offers students an opportunity to examine standard health informatics material in fresh ways or new health informatics material that is not covered in formal courses. May be repeated up to two times.

**HINF 6201. Organizational Behavior, Work Flow Design, and Change Management. (3 Hours)**

Reviews the concepts, issues, and practices of organizational behavior at the individual, group, and organizational levels. Offers an opportunity to learn how to gather information from users and understand the users' point of view and problems. Examines processes and work flow in healthcare environments. Seeks to explain organizational structures and analyze business processes and how they are translated into specifications to build a RFP for vendors. Also examines fundamentals of organizational behavior and change management.

**HINF 6202. Business of Healthcare Informatics. (3 Hours)**

Focuses on the business practices relating to health information technology. Includes departmental design and management, capital and operating budgets, the budget planning process, and infrastructure design and strategic planning. Other topics include evaluation of vendors, vendor selection, clinical administration systems, and the design and management of integrated delivery networks.

**HINF 6205. Creation and Application of Medical Knowledge. (3 Hours)**

Explores the relationship between clinical data and clinical knowledge and how both are developed and deployed in organizations to support improvements in patient care and research. Topics covered include what medical data is available and how it should be accessed, analyzed, and organized to support evidence-based medicine and research. Analyzes current and future approaches to clinical decision support and expert system development and how they can be deployed via new or existing knowledge-management infrastructures.

**HINF 6215. Project Management. (3 Hours)**

Introduces students to managing healthcare informatics projects, including the tools and techniques used to manage small, medium, and large software and systems projects. Topics include project planning, project management tools, estimating, budgeting, human resource management, and the like. All phases of a project are discussed, and students are required to develop a project plan for a health informatics project as part of the course.

**HINF 6220. Database Design, Access, Modeling, and Security. (3 Hours)**

Designed to provide an introduction to the theory and application of database management systems. Topics covered include the relational model, basic and intermediate query formulation using structured query language, database design using the entity relational model, and database normalization and optimization. In addition to these traditional topics, this course covers a sample of emerging topics relevant to the healthcare professional, including personal health information, privacy and security considerations, XML as a data model, and clinical data warehousing and mining.

**HINF 6240. Improving the Patient Experience through Informatics. (3 Hours)**

Explores the current and future dynamics influencing care for patients. The patient experience is a key differentiator in delivery of healthcare. Technology makes a difference for the patient in both the delivery of advanced care applications and innovation. Discusses and explores technology and workflow enhancements that could work to improve the patient experience from a cost, quality, and care perspective. Examines best practices and organizations and evaluates how they are using informatics to deliver a better patient experience. Analyzes change management and why change is difficult within healthcare and explores case studies on how to make change happen and the role that change plays in connection with technology. People, process, and technology all need to be present to offer an ideal experience.

**HINF 6335. Management Issues in Healthcare Information Technology. (3 Hours)**

Uses case studies to identify typical issues confronting chief information officers in healthcare organizations, including human resource management, strategic planning, project management, vendor contract negotiations, budgeting, service levels, etc. Requires prior completion of HINF 5101.

**HINF 6345. Design for Usability in Healthcare. (3 Hours)**

Introduces the general principles of usability and user interface design as they relate to healthcare technology. Through a series of hands-on projects, offers students an opportunity to gain skill in user-centered/UX research and design methodologies such as interviewing, persona creation, task analysis, usability testing, prototyping, and iterative design. Class materials, exercises, and discussions cover usability and design for EHRs/ EMRs, connected health, smart home products, and interoperability. While there are no prerequisites for this course, the material is directed toward advanced students who need to understand how to design usable interactive products and software within healthcare so they can either do the work themselves or manage this function within a project.

**HINF 6350. Public Health Surveillance and Informatics. (3 Hours)**

Offers students an opportunity to learn how public health information is generated, collected, transferred, and shared. Discusses the principles and practice of public health surveillance as well as the application of health informatics standards and methods in the design of surveillance systems. Also reviews the core components of analysis and interpretation of population data. Non-health informatics students may be able to take the course with permission of the program director.

**Prerequisite(s):** HINF 5101 with a minimum grade of D- or HINF 5101 with a minimum grade of C- (Graduate)

**HINF 6355. Interoperability Key Standards in Health Informatics. (3 Hours)**

Reviews the different healthcare informatics standards for storing and exchanging data in healthcare technology systems. Covers where and how they are used, where and why they are not used, and an overview of some of the types of products available to facilitate their use. Seeks to demystify the details behind the standards. Offers students an opportunity to work through examples in small groups in class and discuss issues involving the standards' adoption and use. Non-health informatics students may be able to take the course with permission of the program director.

**Prerequisite(s):** HINF 5101 with a minimum grade of D- or HINF 5101 with a minimum grade of C- (Graduate)

**HINF 6400. Introduction to Health Data Analytics. (3 Hours)**

Introduces the field of health data analytics. Topics include understanding stakeholder needs; the variety of types of health data; software tools; as well as case studies from pharma, public health, electronic health records, claims data, and home-monitoring data. Emphasizes the importance of understanding the complexity and potential biases in how health data (direct or indirect) is collected and represented. Presents all data-analytic discussions within a context of health data and stakeholder information needs. Offers students an opportunity to practice presenting the results of analyses. Requires a basic knowledge of statistics.

**HINF 6404. Patient Engagement Informatics and Analytics. (3 Hours)**

Studies patient engagement and health informatics systems and analyses of data collected from these systems. Patient engagement is the ability and willingness of patients to manage their own health and care combined with interventions to increase patient involvement in their own health and care, as well as other positive health behaviors. In these interventions, health informatics systems and analyses of data are used. Offers students an opportunity to engage in data analytic exercises to investigate the underlying design and implementation of health informatics systems used in patient engagement initiatives. Presents an overview of the current state, new technologies, and other areas (health reform, legal, privacy, quantified self) influencing the future direction of patient engagement.

**HINF 6405. Quantifying the Value of Informatics. (3 Hours)**

Examines the various ways in which health informatics delivers value to organizations. Organizations invest in informatics because they believe that doing so will enable them to meet their objectives. The course offers students a series of tools to use to quantify value, which can help them to articulate and assess the value of potential investments in informatics. Examines case studies to offer students an opportunity to practice articulating the value of informatics in real settings.

**HINF 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HINF 7701. Health Informatics Capstone Project. (3 Hours)**

Offers students an opportunity to integrate knowledge gained in the classroom with real-world problems. Consists of practical work and research in a major area of health informatics. Potential areas of work include design or analysis of health informatics systems, programs, or applications; program planning; and policy development. Encourages community-based participatory projects. To the extent possible, capstone projects have as a goal an active contribution to the health informatics field. Students initiate and design capstone projects in consultation with working professionals. Faculty members provide guidance and mentoring. Requires prior completion of at least three semesters of graduate study in health informatics.

**HINF 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**HINF 7990. Thesis. (3 Hours)**

Offers supervision and oversight of master's thesis in a selected topic under the direction of the faculty in fulfillment of the requirements for the degree. Requires students to submit a written thesis. May be repeated twice.

**Prerequisite(s):** (PHTH 5210 with a minimum grade of B- or PHTH 5210 with a minimum grade of B- or PHTH 5210 with a minimum grade of B- ); (CS 6350 with a minimum grade of B- or HINF 5200 with a minimum grade of B- )

**HINF 8982. Readings. (1-8 Hours)**

Offers selected readings under the supervision of a faculty member. *Personal health informatics PhD students only..*

**HINF 8984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated up to four times.

**HINF 8986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated up to four times.

**HINF 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of program requirements for PhD candidacy.

**HINF 9990. Dissertation Term 1. (0 Hours)**

Offers selected work with the agreement of a dissertation supervisor.

**Prerequisite(s):** HINF 9000 with a minimum grade of S

**HINF 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** HINF 9990 with a minimum grade of S

**HINF 9996. Dissertation Continuation. (0 Hours)**

Continues work with the agreement of a dissertation supervisor.

**Prerequisite(s):** HINF 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Health Management - CPS (HMG)

**HMG 1100. Foundations of Healthcare Management. (3 Hours)**

Examines the management of health services organizations (HSOs) and health systems from management functions, concepts, and principles to managerial roles, skills, and competencies within the context of HSOs and health systems and their external environment. Introduces managerial tools and techniques for managing effectively in the HSO/health systems environment. Emphasizes how health managers solve problems, make decisions, and conduct strategic planning. Studies the roles played by quality, productivity, and technology in establishing and maintaining a competitive position and how managers seek to manage the complex human relationships that exist within HSOs and health systems as well as other agencies and external stakeholders.

**HMG 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HMG 2100. Healthcare Operations. (3 Hours)**

Focuses on operations management planning and execution. Explores the challenges of restructuring and control common to hospitals and other health services organizations.

**Prerequisite(s):** HMG 1100 with a minimum grade of D- or MGT 1100 with a minimum grade of D-

**HMG 2110. Health Law and Regulation. (3 Hours)**

Examines the impact of health law and regulation on healthcare systems. Explores how to assess liability in the workplace, the impact of medical malpractice, risk management, and current ethical and legal dilemmas in the practice of medicine. Discusses how to manage the risk of the employer and patient through the use of medical records and specific behavior patterns, how to determine personal risk, and how to recognize potential litigious issues in the practice of medicine.

**Prerequisite(s):** HMG 1100 with a minimum grade of D- or MGT 1100 with a minimum grade of D-

**HMG 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HMG 3210. Health Informatics. (3 Hours)**

Focuses on information systems in healthcare. Topics include information architectures, administrative and clinical applications, evidence-based medicine, information retrieval, decision support systems, security and confidentiality, the electronic health record, integration of key health information systems, and medical devices.

**Prerequisite(s):** HMG 1100 with a minimum grade of D- or MGT 1100 with a minimum grade of D-

**HMG 3220. Risk Management and Quality Assurance. (3 Hours)**

Explores aspects of quality management within the healthcare arena. Studies legislative mandates, healthcare agencies' requirements, and methods of assessing and improving the quality of care. Emphasizes the procedures utilized to monitor physician and professional staff reappointment and credentialing. Discusses integration of the research process to conduct performance monitoring, quality improvement, and risk assessment. Emphasizes using statistical analysis to inform decision making.

**Prerequisite(s):** HMG 2100 with a minimum grade of D-

**HMG 3225. Public Health. (3 Hours)**

Introduces the history and principles of public health and their application to the development of activities that benefit the health status of populations. Explores the roles of epidemiological studies, biostatistics, healthcare planning and policy development, healthcare administration, and community organization in addressing public health needs.

**Prerequisite(s):** HMG 1100 with a minimum grade of D- or MGT 1100 with a minimum grade of D-

**HMG 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HMG 4210. Healthcare Policy. (3 Hours)**

Examines the healthcare policy environment, including the economics and politics of healthcare policy. Explores institutional, local, regional, national, and international approaches to public health, health systems, and determination of research and development priorities. Discusses a variety of critical, contemporary policy issues such as health insurance, Medicare and Medicaid, the increase of medical expenditures, the malpractice crisis, the evolution of managed care, and a comparison of other nations' healthcare systems.

**Prerequisite(s):** HMG 3225 with a minimum grade of D- or HSV 3300 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**HMG 4850. Healthcare Management Capstone. (3 Hours)**

Offers students an opportunity to integrate knowledge gained in the classroom with real-world problems. Consists of practical work and research in a major area of healthcare management. Students initiate and design capstone projects in consultation with faculty and working professionals.

**Prerequisite(s):** HMG 4210 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**HMG 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**HMG 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HMG 4994. Internship. (3 Hours)**

Offers students an opportunity to participate in an internship in a healthcare organization.

**Prerequisite(s):** HMG 3220 with a minimum grade of D-

**Attribute(s):** NUpath Integration Experience

**HMG 6110. Organization, Administration, Financing, and History of Healthcare. (3 Hours)**

Provides a historical context for the current healthcare system, the current economic drivers, the leading integrated delivery systems, political pressures, ethical issues, and the roles of insurance and pharmaceutical companies.

**HMG 6130. Healthcare Strategic Management. (3 Hours)**

Focuses on analyzing, planning, negotiating, problem solving, and decision making for healthcare systems managers in a risk-based environment. Strategic management as practiced in healthcare functional units, clinics, and hospitals is rapidly changing in today's technology-driven environment. Planning and management strategy at all levels are essential to the organization.

**HMG 6140. Principles of Population-Based Management. (3 Hours)**

Covers epidemiological analysis of health and health services with an emphasis on assessment of cost and benefits of population-based interventions. Special topics include community health assessments, the monitoring of community health indicators, and the evaluation of community health improvement activities. Includes strategies for the analysis of potential and actual health-risk factors and the discovery and implementation of appropriate risk-reduction strategies.

**HMG 6160. Healthcare Information Systems Management. (3 Hours)**

Offers students an opportunity to understand how to manage high-technology systems, tools, and products and to provide a conceptual framework for understanding how to use technology to reduce costs and improve productivity, efficiency, and effectiveness in their current and future work situations. Today's health practitioner has to use technology to find medical information and use accounting systems, personal systems, health insurance company systems, inventory systems, patient billing systems, purchasing systems, as well as input and retrieve data. Focuses on the business of healthcare and how to understand, use, and manage technology and information systems that have become such an integral part of the health delivery spectrum in a medical environment.

**HMG 6170. Health Law, Politics, and Policy. (3 Hours)**

Surveys the legal foundations of healthcare and applies current case law to contemporary situations. Topics include legal aspects of legislation, patient rights, data security, professional liability, labor relations, and the politics of healthcare reform. Issues include the high price of prescription drugs and why they are less expensive in Canada and overseas. Do rising medical costs produce better health? How should a Medicare prescription drug benefit be designed? Should kidneys and other organs be bought and sold? Includes case studies and group projects related to these questions and/or others as they emerge.

**HMG 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HMG 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

## Health Science - Interdisciplinary (HLTH)

### **HLTH 1203. Basic Clinical Skills for the Healthcare Professional. (3 Hours)**

Introduces undergraduate students to the basic knowledge and skills necessary to be successful in entry-level healthcare positions. Provides students with hands-on opportunities to learn skills in Basic Life Support, safe patient handling, determining vital signs, oxygen transport and safety, EKG prep and placement, and related clinical skills.

### **HLTH 1205. Wellness. (4 Hours)**

Explores the concept of wellness and examines behaviors and lifestyle choices that lead to a high level of physical, emotional, and spiritual well-being. Guides students through essential concepts of nutrition, the importance of physical activity, and effective stress management techniques. Reviews topics such as health risk, behavioral change, lifestyle analysis, the life cycle, and stress management through self-analysis.

### **HLTH 1250. Introduction to Health Professions. (3 Hours)**

Uses a foundation in interprofessional education competencies to introduce students to careers in the health professions including medicine, nursing, rehab sciences, mental health/behavioral sciences, and other health professions. Discusses roles and responsibilities for each covered discipline as well as common values, ethics, and commitment to patient safety and confidentiality. Introduces fundamentals of the U.S. healthcare system, concepts in public health, health equity and access to care, legal issues in health, health industries and health entrepreneurship, and health-related technologies including artificial intelligence. Explores issues of burnout and introduces strategies for personal resistance and wellness. Engages students in goal setting and planning their professional journey.

### **HLTH 1717. Enriching Lives Through Behavior Change Interventions. (4 Hours)**

Presents the skills required to work directly with learners receiving applied behavior analytic services. Explores the science of behavior and offers students an opportunity to practice assessing behavior, teaching new skills, and helping reduce behaviors that interfere with learners' own goals. Emphasizes compassionate care and inclusion of learners and their families as team members.

### **HLTH 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **HLTH 2100. Interprofessional Ethics for Individual and Population Health. (4 Hours)**

Explores basic theories, principles, and contemporary issues of bioethics with an interprofessional focus. Considers ethical issues related to genetics, clinical practice, social work, and legal decisions. Offers students an opportunity to work as a team and respect interprofessional viewpoints to address realistic ethical dilemmas that are encountered in contemporary healthcare. Relevant for all students interested in expanding their view and appreciation of health dilemmas.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Writing Intensive

### **HLTH 2183. Interdisciplinary Special Topics: Pop-up Course. (1,2 Hours)**

Addresses timely trends, issues, and events as they unfold. Offers students an opportunity to learn about and respond to issues of the day in an immersive, interdisciplinary, short-course format. Content and instructors vary by offering. May be repeated five times for a maximum of eight semester hours.

### **HLTH 2200. Emergency Medical Technician Training. (6 Hours)**

Offers students an opportunity to learn basic healthcare clinical skills and seeks to prepare students to function as emergency medical technicians (EMTs) at the basic life support level. EMTs are an essential component of prehospital emergency medical service (EMS) systems. This course seeks to establish a solid foundation in EMS, broadly including patient assessments, medical emergencies, trauma emergencies, relevant pharmacology, special populations, and EMS operations.

**HLTH 2302. Alternative Medicine. (4 Hours)**

Presents an objective assessment and discussion of alternative and complementary medical approaches used in the United States and their significant historical, cultural, and cross-cultural implications. The majority of alternative and complementary medical strategies were developed in a specific historical and cultural context. Some of the therapies have had an impact on human health for thousands of years. Others have become popular only recently. Many methods discussed are fused with different cultural practices, such as the concept of "vitalism," a force that modern science does not recognize but is an important attribute in certain cultural practices. Some methods have long and successful histories based upon sophisticated ancient medical theories, such as "Chi" found in Chinese medicine.

**HLTH 2400. Traditional Chinese Medicine: Cross-Cultural Perspectives. (4 Hours)**

Presents how healthcare philosophies, cultural beliefs, and societal structures shape healthcare practices, systems, and policies in both China and the United States. Immerses students in international experiences to explore how Chinese medicine principles#such as Yin-Yang theory, the Five Elements, and Qi energy#influence not only healthcare professionals but also lay people's daily health behaviors, diet, and illness treatment strategies. Examines the intersections of tradition, science, and modern healthcare delivery from a global perspective. Offers students an opportunity to investigate core Chinese medicine practices such as herbal medicine, acupuncture, moxibustion, Tai Chi, and medicinal food therapy. Highlights a global perspective on integrative healthcare, reflecting on how diverse health and cultural beliefs approach wellness, disease prevention, treatment decisions, and patient-centered care.

**HLTH 2500. Entrepreneurship in Health Sciences. (4 Hours)**

Explores in-depth the intersection between entrepreneurship and the health sciences field. Addresses unique opportunities and challenges of starting and managing businesses in the healthcare industry. Covers the fundamental principles of entrepreneurship and applies them specifically to the context of health sciences. Offers students an opportunity to obtain the tools to identify and evaluate innovative healthcare business ideas, develop sustainable business models, and navigate the complex healthcare landscape. Uses case studies to analyze approaches to identify opportunities, develop innovative solutions, and create sustainable businesses that have a positive impact on the health and well-being of individuals and communities.

**HLTH 2550. Product Design, Development, and Innovation in Health Science. (4 Hours)**

Introduces the process of product design, development, and innovation across the health sciences. Presents the tools and methods for creating new products that benefit health and well-being across the life span. Focuses on overall product design methodology, including the identification of customer needs, generation of product concepts, prototyping, and minimal viable product development. Offers students an opportunity to understand regulatory processes for the FDA, medical devices, and digital therapeutics. Reviews go-to-market strategies and provides exposure to the full product development life cycle.

**HLTH 2963. Topics. (1,2 Hours)**

Offers undergraduate students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering. May be repeated three times.

**HLTH 2973. Special Topics in Healthcare. (1-4 Hours)**

Offers an intermediate-level study of contemporary issues in healthcare. Draws upon a variety of perspectives. Offers students an opportunity to expand their breadth of knowledge and to facilitate their understanding of various themes grounded in a particular area of healthcare. May be repeated once.

**HLTH 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HLTH 2992. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**HLTH 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HLTH 4800. Careers in Child and Adolescent Mental Health. (4 Hours)**

Introduces a wide range of careers dedicated to supporting the mental health of children, adolescents, and their families and reducing health inequities. Explores the roles of different mental health professions. Discusses how psychological theories and research findings can be applied to address real-world challenges. Presents firsthand accounts of how professionals design and implement culturally sensitive strategies for prevention, intervention, and advocacy with vulnerable children and youth facing a range of developmental and mental health issues.

**Prerequisite(s):** PSYC 1101 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity

**HLTH 4981. Research—Global. (4 Hours)**

Offers an opportunity to conduct research in global locations under faculty supervision.

**HLTH 4982. Directed Study—Global. (4 Hours)**

Offers independent work in global locations under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated once.

**HLTH 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HLTH 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**HLTH 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**HLTH 4994. Internship. (1-4 Hours)**

Provides students with an opportunity for research internship work. May be repeated up to four times.

**HLTH 4998. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**HLTH 5002. Mindfulness: Theory and Practice. (3 Hours)**

Studies key aspects of theory and practical principles of mindfulness practice. Mindfulness is a particular way of paying attention to experiences that has been scientifically researched and found to decrease habitual and destructive cycles of thought and emotion. This course is highly experiential and daily homework practice consists of at least 20 minutes of mindfulness practice. Instructions for the various practices are provided throughout the course. Each class typically includes a didactic portion, a mindfulness practice, and a group discussion. The benefits of mindfulness practice include reduced stress, improved attention, reduced emotional reactivity, and greater mind-body awareness. Offers students an opportunity to develop practical skills of relational mindfulness in interactions with others and to cultivate positive emotions.

**HLTH 5120. Statistics for Health Science. (3 Hours)**

Focuses on applying formal reasoning to understand the underlying principles of statistics; how to select and conduct statistical tests; and how to interpret and use the results of data analysis in relation to research questions and research hypotheses.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**HLTH 5140. Rural Health in the United States. (1 Hour)**

Presents foundational concepts relevant to rural health in the United States. Covers key definitions, frameworks, and epidemiologic trends in rural health in the United States. Introduces themes of asset- (vs. deficit-) based and responsible community engagement, cultural humility, and empathy in relation to rural communities and their application through experiential learning opportunities. Highlights innovative approaches to addressing rural health inequities and challenges and evidence-based resources for advancing understanding of challenges in rural health. Draws on examples and cases to illustrate and encourage the application of didactic content to real-world problems.

**HLTH 5200. Illusions, the Brain, and Healthcare. (3 Hours)**

Explores the arts and humanities to examine complex concepts in nursing and medicine. Critically evaluates medical information using some of the principles of magic, illusion, and mentalism. Surveys how magic and magic theory inform an array of neuroscientific concepts, cognitive bias, expectation violation, and surprise, with application to clinical practice. Explores the principles of blind spots, misdirection, attention, memory, and influence from the theoretical construct of magic, and applies these principles to concepts in nursing and other medical specialties.

**HLTH 5280. The (in)Visibility of (dis)Ability in Society. (3,4 Hours)**

Addresses the issues of disability relative to culture, public policy, rights, and advocacy. Focuses class discussion on the experiences of people with disabilities living in our current society as well as from a historical perspective. Explores the following topics: who is disabled, social attitudes toward people with disabilities, and images and stigma in the media. Also covers the language of disability, disability culture, and the forgotten minority. Affords students an opportunity to gain a broad understanding of the complex and dynamic issues and themes concerning people with disabilities.

**Attribute(s):** NUpath Difference/Diversity

**HLTH 5301. Clarity and Connection: Pronunciation Skills in English. (3 Hours)**

Explores how diversity in language backgrounds, dialects, and accents can both enrich community and sometimes present challenges in specific situations. Provides an opportunity for high intermediate or advanced non-native English speakers or speakers of non-North American dialects of English to learn general strategies for improving comprehensibility across English dialects, as well as some features specific to Mainstream North American English (MAE). Offers opportunities to engage in written and spoken exercises, speaking with partners and in front of a larger group, and preparing for presentations with a focus on pronunciation.

**HLTH 5310. Introduction to Transgender Perspectives in Healthcare. (3 Hours)**

Introduces cultural responsiveness in healthcare fields, specifically related to transgender and gender nonconforming populations. Offers students an opportunity to gain comfort in engaging with this population and develop actionable steps toward more reflective and accountable practices. Examines implicit bias and its impact on interactions in healthcare settings. Explores the ethical requirements and considerations for the provision of services to TGNC populations across all medical and clinical settings.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HLTH 5410. Introduction to Statistics in Health and Behavioral Science. (3 Hours)**

Focuses on applying formal reasoning to understand the underlying principles of statistics. Reviews how to select and conduct statistical tests. Covers how to interpret and use the results of data analysis in relation to research questions and research hypotheses within the realm of behavioral and health sciences.#.

**HLTH 5450. Healthcare Research. (4 Hours)**

Provides an overview of the research process and its application in clinical arenas. Emphasizes the role of the health professional as a consumer of research, with concern for the ethical management and treatment of patients and their families. Elements of research design and their implications in clinical settings provide the framework for the analysis of research and the development of a research proposal. Also emphasizes the use of research findings for evidence-based practice. Encourages interdisciplinary projects.

**Prerequisite(s):** (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C ) or graduate program admission

**Attribute(s):** NUpath Formal/Quant Reasoning, NUpath Natural/Designed World, NUpath Writing Intensive

**HLTH 5600. Introduction to Patient Safety. (3 Hours)**

Introduces patient safety science, which is a growing specialty in healthcare, driven by research and reporting efforts that demonstrate unacceptable levels of patient harm in care delivery. Provides a comprehensive overview of the tools and knowledge necessary for healthcare clinicians, administrators, and leaders to create safer healthcare systems. Explores the major themes of patient safety science and the concepts utilized in designing safer healthcare systems and mechanisms for healthcare delivery. Focuses on the history of patient safety, political and regulatory drivers and their impact on patient safety, the importance of robust data capture in recognizing risks, and the inherent challenges of informatics and technology for patient safety. Applying these concepts guides design of safer healthcare.

**HLTH 5610. Patient Safety Science. (3 Hours)**

Examines healthcare as a high-risk industry, where complex healthcare systems attempt to meet the complex needs of diverse patients. Introduces the many drivers that influence the design and evolution of healthcare systems, particularly patient safety, which until recently was not typically recognized as one of these design drivers. Expands on the concept of complex systems theory and introduces the concept of high reliability organizations (HROs) and how they approach safety. Examines engineering strategies from HROs by studying how healthcare systems should adapt and retrofit to create safer systems of care delivery. Compares the challenges of improving patient safety at the system vs. the microsystem level. Examines diverse error-reducing strategies.

**Prerequisite(s):** HLTH 5600 (may be taken concurrently) with a minimum grade of B or HLTH 5600 (may be taken concurrently) with a minimum grade of B

**HLTH 5620. Leadership, Patient Safety, and Clinician Wellness. (3 Hours)**

Examines patient-safety-focused leadership that recognizes the importance of partnering with key healthcare proponents to advance the safe delivery of care. Discusses the role of leaders in advancing a culture of safety and creating a just culture approach to adverse event reviews. Identifies the importance of psychological safety in adverse event reporting and analysis. Focuses on leadership roles in promoting robust workforce wellness initiatives to prevent clinician burnout.

**Prerequisite(s):** HLTH 5600 (may be taken concurrently) with a minimum grade of B or HLTH 5600 (may be taken concurrently) with a minimum grade of B

**HLTH 5630. Quality Improvement in Patient Safety. (3 Hours)**

Introduces key components of patient safety science that promote identification of patient safety risks and effectively foster changes to reduce those risks. Examines the processes and tools employed in quality improvement efforts and recognizes the importance of risk assessment, data collection, and measurement in healthcare settings. Identifies quality improvement models and compares their effectiveness in promoting safer care delivery. Concludes with a discussion of the advantages and disadvantages of incentivizing quality improvement efforts through reimbursement strategies that utilize quality incentives.

**Prerequisite(s):** HLTH 5600 (may be taken concurrently) with a minimum grade of B or HLTH 5600 (may be taken concurrently) with a minimum grade of B

**HLTH 5700. Social Determinants of Health. (3 Hours)**

Introduces social and structural conditions as key contributors to people's physical and mental health. Describes unjust and avoidable socioeconomic conditions considered to be the main contributors to health inequities. Meets a growing demand for health professionals to have fundamental knowledge of the social determinants of health, including social isolation and social support; structural/ institutional racism; income inequality; and social and economic policies. Provides an opportunity to develop awareness of the role of social determinants of health in population health; knowledge of the pathways through which they impact health; awareness of the specific ways the health of different populations and demographic groups is impacted; and enhanced evaluation, diagnosis, and communication with patient and clients.

**Attribute(s):** NUpath Societies/Institutions

**HLTH 5800. AI Across the Health Sciences. (4 Hours)**

Presents foundational information about artificial intelligence and its applications in healthcare, public health, pharmacology, and pharmaceutical sciences. Develops AI literacies for entry-level clinical practice, public health, and health-related careers. Provides an overview of the history of AI, most common types of AI approaches, and state-of-the-art of AI in health-related applications. Distinguishes realities from hype around AI's capabilities and limitations and reviews ethical and regulatory considerations. Offers students experiential opportunities to build a conceptual AI solution to a real-world problem in the health space. Technical background in AI/computer science not required.

**HLTH 5963. Topics. (1,2 Hours)**

Offers students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering. May be repeated three times.

**HLTH 5964. Projects for Professionals. (0 Hours)**

Offers students an applied project setting in which to apply their curricular learning. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review 'lessons learned,' and incorporate suggestions from this review to improve and further develop their career development and professional plan.

**HLTH 5965. Engaging with Industry Partners for Rising Professionals. (0 Hours)**

Offers students an enhanced applied project setting in which to apply their curricular learning. Working with a partner sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with the partner sponsor, and create a plan for implementing their recommendations. Curriculum supports students as they develop key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review lessons learned, and incorporate suggestions to improve and further hone their career development and professional plan. Career development opportunities through skill-building workshops, panels, and interview preparation are available. Partner-student interactions, including a culminating project presentation, allow partners to assess student potential for co-op, internship, or other employment opportunities with the partner.

**HLTH 5973. Special Topics in Healthcare. (1-4 Hours)**

Offers an advanced-level study of contemporary issues in healthcare. Draws upon a variety of perspectives. Offers students an opportunity to expand their breadth of knowledge and to facilitate their understanding of various themes grounded in a particular area of healthcare. May be repeated up to five times for up to 6 total credits.

**HLTH 6961. Internship. (1-4 Hours)**

Offers students an opportunity for internship work. May be repeated up to three times.

**HLTH 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HLTH 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated seven times.

**HLTH 7999. Extended Field Experience. (0 Hours)**

Offers supervised field experience.

**Health Science (HSCI)****HSCI 1000. College: An Introduction. (1 Hour)**

Provides an introduction to the University, college, and health professions to enhance students' understanding of self and the decisions they make academically and socially as members of the University's diverse, multicultural community. Group activities and individual assignments along with active participation in a learning community help students adjust to life on an urban campus, develop a better understanding of the learning process, acquire essential academic skills, and make connections with the faculty and students in the college.

**HSCI 1105. Human Nutrition. (4 Hours)**

Examines the fundamental role of nutrition in promoting health and how lifestyle and the socioecological model work together. Covers the physiological functions of energy-providing nutrients in the body and interrelationships, including the key functions of macronutrients and micronutrients. Introduces the use of two different diet assessment tools to assist individuals in selecting food for health promotion. Offers students an opportunity to gain a deeper understanding of what it means to make healthy choices and the role nutrients have on a person's wellness.

**Prerequisite(s):** BIOL 1107 (may be taken concurrently) with a minimum grade of C- or BIOL 1111 (may be taken concurrently) with a minimum grade of C- or BIOL 1115 (may be taken concurrently) with a minimum grade of C- or BIOL 1117 (may be taken concurrently) with a minimum grade of C- or BIOL 1147 (may be taken concurrently) with a minimum grade of C- or BIOL 2217 (may be taken concurrently) with a minimum grade of C- or CHEM 1101 (may be taken concurrently) with a minimum grade of C- or CHEM 1161 (may be taken concurrently) with a minimum grade of C- or CHEM 1211 (may be taken concurrently) with a minimum grade of C- or HSCI 1106 with a minimum grade of C- or PHSC 2301 (may be taken concurrently) with a minimum grade of C- or PHSC 2303 (may be taken concurrently) with a minimum grade of C-

**Attribute(s):** NUpath Natural/Designed World

**HSCI 1106. Contemporary Issues in Nutrition. (4 Hours)**

Explores the fundamental role of nutrition in promoting health. Offers an overview of nutrient functions, compositions, and digestion/absorption. Relates concepts covered in class to current topics of interest in nutrition. Offers students an opportunity to discuss their dietary behaviors in relation to the Dietary Guidelines for Americans.

**Attribute(s):** NUpath Natural/Designed World

**HSCI 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HSCI 2000. Professional Development for Bouvé Co-op. (1 Hour)**

Introduces students to the Bouvé Cooperative Education Program and provides them with the opportunity to develop job-search and career-management skills. Offers students an opportunity to perform assessments of their workplace skills, interests, and values and discuss how they impact personal career decisions. Students also have an opportunity to prepare a professional-style résumé, learn proper interviewing techniques, and gain an understanding of the opportunities available to them for co-op. Introduces career paths, choices, and career decision making. Familiarizes students with workplace issues relative to their field of study and teaches them to use myNEUCOOL database in the job-search and referral process. Presents and discusses co-op policies, procedures, and expectations of the Bouvé Cooperative Education Program and co-op employers.

**HSCI 2350. Advanced Nutrition in Health and Disease. (4 Hours)**

Designed for health professionals to increase their knowledge and skills in advanced nutrition in health and disease. Builds on a foundation of nutrition and introduces nutrients and their physiological impacts, including the nutritional guidelines for good health and disease prevention. Through case studies, offers students an opportunity to interpret nutrition in the prevention and treatment of diet-related health problems, such as obesity, diabetes, and cardiovascular disease.

**Prerequisite(s):** HSCI 1105 with a minimum grade of C

**HSCI 2500. Public Health Nutrition in the Community. (4 Hours)**

Explores the role nutrition plays in promoting and improving health in the community. Examines modern aspects of public health nutrition in the healthcare system by applying the principles of nutrition to design policies, behavior, program planning, food insecurity, marketing, and children and adult nutrition programs. Offers students an opportunity to develop and deliver nutrition education to various populations in the community, including school-age children, college students, and the elderly population.

**Prerequisite(s):** HSCI 1105 with a minimum grade of C

**HSCI 2983. Special Topics. (4 Hours)**

Offers students an opportunity to participate in a small seminar to explore selected topics within the vast subject of healthcare. May be repeated twice.

**HSCI 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HSCI 2991. Research in Health Science. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated once.

**HSCI 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HSCI 4700. Health Science Capstone Introduction. (0 Hours)**

Offers students an opportunity to integrate their coursework, knowledge, and experiences into a proposal for a spring semester capstone experience. Students propose their health science culminating experience from options in the form of developing and implementing their own project with faculty mentor support or participating in a faculty-led seminar.

**Prerequisite(s):** PHTH 2210 with a minimum grade of C ; (PHTH 2300 with a minimum grade of C or PHTH 2301 with a minimum grade of C ); (PHTH 2350 with a minimum grade of C or PHTH 2351 with a minimum grade of C ); PHTH 2515 with a minimum grade of C ; (ENGW 3302 with a minimum grade of C or ENGW 3304 with a minimum grade of C or ENGW 3306 with a minimum grade of C or ENGW 3307 with a minimum grade of C or ENGW 3308 with a minimum grade of C or ENGW 3314 with a minimum grade of C or ENGW 3315 with a minimum grade of C )

**HSCI 4720. Health Science Capstone—Service. (4 Hours)**

Offers students an opportunity to integrate their course work, knowledge, and experiences into a project that results in a written report and presentation regarding an issue within the field of health or healthcare. The project is a culminating experience in the health science program. Includes working with a mentor in a field experience in public health education or health policy, public affairs, social service, or other healthcare environment in which the student is qualified. Requires students to present their projects to the seminar class and possibly to the agency or group with which they are working.

**Prerequisite(s):** HSCI 4700 with a minimum grade of S

**Attribute(s):** NUpath Capstone Experience

**HSCI 4730. Health Science Capstone—Research. (4 Hours)**

Offers students an opportunity to integrate their course work, knowledge, and experiences into a project that results in a written report and presentation regarding an issue within the field of health or healthcare. The project is a culminating experience in the health science program. Students may choose to participate in an ongoing research project or create and implement their own research project as their capstone project. Requires students to present their projects to the seminar class and possibly to present a poster at a professional/research expo.

**Prerequisite(s):** HSCI 4700 with a minimum grade of S

**Attribute(s):** NUpath Capstone Experience

**HSCI 4740. Health Science Capstone Seminar. (4 Hours)**

Offers intensive study on the public health approach to a specific, relevant issue. Through a combination of close readings of empirical literature and interactive class discussion, students critique public health approaches and policies regarding the topic of the seminar. Requires students to complete an in-depth study, write a paper, and present their findings on a topic of interest within the larger discussion.

**Attribute(s):** NUpath Capstone Experience

**HSCI 4950. Seminar. (4 Hours)**

Offers students an opportunity for an in-depth study of selected topics within healthcare.

**HSCI 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated without limit.

**HSCI 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field.

**Prerequisite(s):** HSCI 4970 with a minimum grade of C

**Attribute(s):** NUpath Capstone Experience

**HSCI 4983. Topics. (4 Hours)**

Offers students an opportunity to study contemporary issues in healthcare and to expand their breadth of knowledge and engage diverse perspectives.

**HSCI 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HSCI 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**HSCI 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**HSCI 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**HSCI 5130. Introduction to Real-World Evidence. (2 Hours)**

Introduces students to the generation of real-world evidence (RWE) from real-world data (RWD) collected through different forms of observational health data. Examines how RWE is used to inform regulators and other stakeholder groups in life sciences and healthcare. Emphasizes the role of team science in executing an RWE analysis.

**HSCI 5140. Foundations of Data Models. (2 Hours)**

Introduces students to design principles behind data modeling in life sciences and healthcare. Examines and compares approaches to common data models across different research communities. Explores the rationale for popular data models through the use of industry case studies.

**HSCI 5150. Methods for Observational Research 1. (3 Hours)**

Surveys approaches to observational research across pharmacoepidemiology, emphasizing approaches used by the Observational Health Data Sciences and Informatics community.

**HSCI 5151. Methods for Observational Research 2. (3 Hours)**

Examines advanced methods in conducting observational research across pharmacoepidemiology, emphasizing approaches used by the Observational Health Data Sciences and Informatics community. Focuses on using open-source software and open-science principles to conduct and interpret a real-world evidence (RWE) study.

**Prerequisite(s):** HSCI 5150 with a minimum grade of B- or HSCI 5150 with a minimum grade of B-

**HSCI 5160. Standardization of Real-World Data. (2 Hours)**

Introduces students to the principles of interoperability protocols in healthcare and life sciences to support clinical data standardization. Explores the process of extract, transform, and load (ETL) in the harmonization of healthcare data. Emphasizes real-world case studies driving current standardization approaches.

**Prerequisite(s):** HSCI 5140 with a minimum grade of B- or HSCI 5140 with a minimum grade of B-

**HSCI 5170. Data Model Transformation. (2 Hours)**

Examines the process for transforming data into a common representation that can be used across research environments. Covers the technical and business processes for data model adoption. Establishes the framework for evaluating data quality and the implementation of agile principles in data model release management.

**Prerequisite(s):** HSCI 5140 with a minimum grade of B- or HSCI 5140 with a minimum grade of B-

**HSCI 5180. Phenotyping. (2 Hours)**

Surveys the process for constructing heuristics to define a population of interest in observational research. Emphasizes the principles of phenotype curation across real-world data feeds and strategies to ensure robust, reproducible research.

**Prerequisite(s):** (HSCI 5130 with a minimum grade of B- or HSCI 5130 with a minimum grade of B- ); (HSCI 5140 with a minimum grade of B- or HSCI 5140 with a minimum grade of B- )

**HSCI 5190. Cohort Building. (2 Hours)**

Examines approaches to defining cohorts in pharmacoepidemiology, emphasizing common analytical tools, knowledge objects, and assessing the appropriateness of clinical heuristics to answer a clinical study question.

**HSCI 5255. Tools and Techniques of Environmental Health. (4 Hours)**

Introduces basic concepts of environmental health sciences, methods used to study the interface of health and the environment, the health impacts of various environmental processes and exposures, and public health approaches to controlling or eliminating environmental health risks. Covers basic environmental health principles, such as exposure assessment, environmental toxicology, environmental epidemiology, and risk assessment. Also covers specific environmental health issues including toxic exposures from chemicals used in plastics, food production, and everyday household products; water and air pollution; climate change; and other environmental drivers of disease.

**HSCI 6110. Advanced Population Characterization. (2 Hours)**

Introduces students to the design principles of population-level characterization studies at scale, emphasizing the use of common data models and shared analytical approaches to implement reproducible, repeatable research.

**Prerequisite(s):** HSCI 5150 with a minimum grade of B- or HSCI 5150 with a minimum grade of B- or HSCI 5180 with a minimum grade of B- or HSCI 5180 with a minimum grade of B-

**HSCI 6120. Advanced Population Estimation. (3 Hours)**

Introduces students to the design principles of causal inference studies (population-level effect estimation) at scale, emphasizing the use of common data models and shared analytical approaches to implement reproducible, repeatable research. Covers a framework for study diagnostics including empirical equipoise, covariate balance, negative control calibration, empirical null distribution, and power.

**Prerequisite(s):** HSCI 5150 with a minimum grade of B- or HSCI 5150 with a minimum grade of B-

**HSCI 6130. Advanced Patient Prediction. (3 Hours)**

Introduces students to the design principles of patient-level prediction studies at scale, emphasizing the use of common data models and shared analytical approaches to implement reproducible, repeatable research. Covers frameworks for evaluating internal and external validity of machine learning models constructed using real-world data.

**Prerequisite(s):** HSCI 5150 with a minimum grade of B- or HSCI 5150 with a minimum grade of B-

**HSCI 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HSCI 6980. Real-World Evidence Capstone. (3 Hours)**

Offers students an opportunity to complete a specialized research or applied capstone project in real-world data strategy and evidence generation as part of the master's degree. Designed to meet the specific learning and research interests of the student to prepare for a career in healthcare and life sciences. Learning experience is based on independently led activities that meet agreed-upon benchmarks with the faculty-mentor. Activities may include working with healthcare, life sciences, regulatory, and/or technology organizations.

**Prerequisite(s):** (HSCI 5151 with a minimum grade of B- or HSCI 5151 with a minimum grade of B- ) or (HSCI 5180 with a minimum grade of B- or HSCI 5180 with a minimum grade of B- ) or (HSCI 5190 with a minimum grade of B- or HSCI 5190 with a minimum grade of B- )

## Health Science - CPS (HSC)

### HSC 1200. Nutrition. (3 Hours)

Explores the fundamental role of nutrition in promoting health, wellness, and prevention of chronic disease. Topics include nutrients and nutritional needs across the life span; food safety and security; body weight regulation; and the genetic, social, and environmental influences on food choices and nutrition status.

**Attribute(s):** NUpath Natural/Designed World

### HSC 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### HSC 2990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### HSC 3300. Epidemiology. (3 Hours)

Introduces the principles, concepts, and methods of population-based epidemiology—the study of patterns and determinants of disease in different populations. Topics include the dynamic behavior of disease; measures of disease frequency and effect; uses of rates, proportions, and other statistics to describe the health of populations; epidemiologic study designs; and bias in investigating the extent of disease problems and the associations between risk factors and disease outcomes.

**Prerequisite(s):** MTH 2300 with a minimum grade of D- or MTH 2310 with a minimum grade of D- or MTH 3300 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Writing Intensive

### HSC 3320. Pharmacology. (3 Hours)

Offers the fundamentals of pharmacology to students entering the health professions. Topics include the general principles of drug action, drug distribution, and drug elimination. Focuses on principles of pharmacology and the major drug classifications in relation to the treatment of health problems. Emphasizes dose response, side effects/drug interactions, route of administration, and place in clinical therapy. Drugs are presented according to therapeutic or functional classification.

**Prerequisite(s):** CHM 1200 with a minimum grade of D- ; CHM 1201 with a minimum grade of D-

### HSC 3990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### HSC 4850. Project in Health Science. (3 Hours)

Offers students an opportunity to integrate knowledge gained in the classroom with real-world problems. Students initiate and design a capstone project in health science in consultation with faculty and working professionals.

**Prerequisite(s):** HSC 3300 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

### HSC 4955. Project. (1-4 Hours)

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

### HSC 4990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Hebrew (HBRW)

### HBRW 1101. Elementary Hebrew 1. (4 Hours)

Designed for students with little or no prior knowledge of Hebrew. Presents a lively introduction to basic oral expression, listening comprehension, and elementary reading and writing. Uses practical vocabulary drawn from realistic situations, and aims at good pronunciation and ease in response.

### HBRW 1102. Elementary Hebrew 2. (4 Hours)

Continues HBRW 1101. Includes continued focus on oral expression, listening comprehension, and elementary reading and writing. Expands functional and practical vocabulary base drawn from realistic situations and focuses on grammatical accuracy. Continues to focus on good pronunciation and ease of response.

**Prerequisite(s):** HBRW 1101 with a minimum grade of C- or HBRW 1301 with a minimum grade of C-

### HBRW 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### HBRW 2101. Intermediate Hebrew 1. (4 Hours)

Emphasizes further vocabulary building. Offers students an opportunity to master the fine points of grammar through written composition, prepared oral reports, and reading and discussion from contemporary Hebrew materials.

**Prerequisite(s):** HBRW 1102 with a minimum grade of C- or HBRW 1302 with a minimum grade of C-

### HBRW 2102. Intermediate Hebrew 2. (4 Hours)

Builds on HBRW 2101 and focuses on further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through written composition, prepared oral reports, and reading and discussion from contemporary Hebrew materials.

**Prerequisite(s):** (HBRW 2101 with a minimum grade of C- or HBRW 2301 with a minimum grade of C-)

### HBRW 2990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### HBRW 3990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### HBRW 4990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### HBRW 4992. Directed Study. (1-4 Hours)

Offers students a way of going beyond work given in the regular curriculum; may also enable students to complete major or minor requirements in certain situations. Priority is given to language majors and to juniors and seniors. May be repeated without limit.

## History (HIST)

### HIST 1000. History at Northeastern. (1 Hour)

Intended for first-year students in the College of Social Sciences and Humanities. Seeks to introduce first-year students to the liberal arts in general, to familiarize them with their history major, to provide grounding in the culture and values of the university community, and to help them develop interpersonal skills.

**HIST 1100. Law and History. (4 Hours)**

Introduces the role of law in shaping human society. Explores how laws have evolved over the past two millennia in different contexts under the influence of different religious systems and political, economic, and social theories. Studies key legal texts and analyzes legal traditions in several regions of the world. Considers how laws have affected the everyday lives of subjects, slaves, and citizens.

**Attribute(s):** NUpath Societies/Institutions

**HIST 1105. Introduction to Trans Studies. (4 Hours)**

Introduces students to the interdisciplinary field of transgender studies by focusing on the emergence of the field, key concepts, and pivotal debates.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 1120. Public History, Public Memory. (4 Hours)**

Explores the politics surrounding the creation and consumption of history outside the classroom. Draws on contemporary debates over memorials, museum displays, television and film, and other popular sources of historical information to answer the questions: How does memory become history? How, where, and why do people encounter and interpret history outside of the classroom? Why are certain versions of the past so controversial? Through readings, discussion, field trips, and assignments, offers students an opportunity to gain a deeper understanding of public history's challenges and opportunities and to develop more informed opinions about its philosophical, ethical, and practical aspects.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**HIST 1130. Introduction to the History of the United States. (4 Hours)**

Engages with the major issues in U.S. history. Topics include the interaction of native populations with European settlers, the American Revolution and the Constitution, slavery, the Civil War, industrialization and migration, the growth of government and rise of the welfare state, media and mass culture, struggles for civil rights and liberation, and America's role in the world from independence to the Iraq wars.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**HIST 1150. East Asian Studies. (4 Hours)**

Seeks to provide an understanding of the constituent characteristics that originally linked East Asia as a region and the nature of the transformations that have occurred in the region over the last two thousand years. Concentrates on China and Japan, and addresses Korea and Vietnam where possible. Also seeks to provide students with effective interdisciplinary analytical skills as well as historical, ethical, cultural diversity, and aesthetic perspectives. ASNS 1150 and HIST 1150 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**HIST 1170. Europe: Empires, Revolutions, Wars, and Their Aftermath. (4 Hours)**

Examines how empires, wars, and revolutions have influenced the development of the modern world, focusing on Europe and Europe's connections with the non-European world. Explores how wars and revolutions led to the emergence of modern concepts of sovereignty, the state, and citizenship and how global competition between states led to the emergence of empires. Traces the promise of allegedly liberating ideologies and the political and economic revolutions they fostered, repeated wars and their aftermaths, and the challenges of recent world developments viewed from the perspective of history. Explores how human diversity and difference have shaped modern societies through history and how human difference and multiculturalism have both fostered and posed challenges to civic sustainability. Interrogates the meanings of "modernity," democracy and totalitarianism, capitalism and socialism, and globalization.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 1185. Introduction to Middle Eastern History. (4 Hours)**

Relies on historical and literary sources, as well as such other cultural artifacts as architecture and photography, and focuses on interaction and changing relations and perceptions between Europe and the Middle East. Surveys the major political and economic events that have linked the trajectory of both civilizations, as well as broad patterns of human activity, such as migrations, conversions, and, cultural exchange. Emphasizes the commonality of encounters, and analyzes the construction of an "other" and its enduring legacy in modern times.

**HIST 1187. Introduction to Latin American History. (4 Hours)**

Surveys major themes in Latin American history from the arrival of the first human inhabitants until the present through a diversity of primary and secondary sources. Examines the social, cultural, political, and economic transformations that shaped Latin America during this period. Emphasizes how concepts of race, class, gender, and sexuality informed these changes and the people's experiences of them. Topics include migration, colonialism and postcolonialism, war and revolution, slavery and abolition, nationalism and nation building, democracy and despotism, urbanization, modernization, religion, imperialism and underdevelopment, human rights, drug policy and international relations, labor, the arts, popular culture, and the environment.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**HIST 1200. Historical Research and Writing. (1 Hour)**

Offered in conjunction with HIST 1201. Introduces incoming history freshmen to the history major in the context of other disciplines within the college and University. Offers students an opportunity to learn and to practice methods and conventions of research and historical writing.

**Corequisite(s):** HIST 1201

**HIST 1201. First-Year Seminar. (4 Hours)**

Provides an introduction to historical methods, research, writing, and argument in which all students produce a substantial research project that passes through at least two revisions, and that is presented publicly to other members of the colloquium.

**Prerequisite(s):** ENGL 1111 (may be taken concurrently) with a minimum grade of C or ENGL 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Corequisite(s):** HIST 1200

**Attribute(s):** NUpath Writing Intensive

**HIST 1206. Drug Trade and Drug War: History, Security, Culture. (4 Hours)**

Analyzes the role of drugs in world history. From the early use of stimulants such as coca and sugar to the "war on drugs" and narco-terrorism, the course examines drugs as commodities in the world economy. Focuses primarily on opiates, stimulants, and hallucinogens from the nineteenth century to the present, considering how changing social and cultural mores led different drugs to be coded as licit and illicit. Topics include traditional uses, early medical use, trade networks, prohibition, black market, and drug cultures, as well as the role of drugs in the histories of industrialization, imperialism, and cold war geopolitics. Sources include historical scholarship, declassified intelligence reports, documentaries, novels, movies, songs, and art.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**HIST 1215. Origins of Today: Historical Roots of Contemporary Issues. (4 Hours)**

Focuses on the historical roots of four pressing contemporary issues with global implications. Our world has grown increasingly complex and interconnected, and the planet's diverse peoples are facing common problems that have tremendous impact on the immediate future. They are (1) globalization, from its origins in the sixteenth century to the present; (2) the potential for global pandemics to alter the course of history, from bubonic plague in the fifth century to H1N1; (3) racial inequality, from religious interpretations in the early modern period to science in the modern era; and (4) gender inequality, from the agricultural revolution forward. For each issue, studies cases and locations spread across the world, examines the links between past and present, and attempts to identify ways forward.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**HIST 1218. Pirates, Planters, and Patriots: Making the Americas, 1492–1804. (4 Hours)**

Seeks to challenge students to understand more than the outlines of American history—Pilgrims, patriots, plantations—in the broader contexts of events that unfolded in and around the Atlantic Ocean in the Americas, Europe, and Africa. Covers Columbus's first landing in the Caribbean to the Haitian declaration of independence in 1804 and includes the Atlantic trade, piracy, slavery and other forms of labor, cultural and ecological exchange, and independence and emancipation.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**HIST 1219. History of Global Pandemics. (4 Hours)**

Explores epidemics and pandemics as a feature of human life for millennia. Charts the history of major pandemics, such as bubonic plague, smallpox, cholera, or the H1N1 influenza of 1918–19. Focuses on the causes and events of each pandemic and also how they shaped the future. Students read multiple primary sources documenting individuals' experience of each pandemic and produce a research project on a pandemic of their choice.

**Attribute(s):** NUpath Interpreting Culture

**HIST 1225. Gender, Race, and Medicine. (4 Hours)**

Examines the basic tenets of "scientific objectivity" and foundational scientific ideas about race, sex, and gender and what these have meant for marginalized groups in society, particularly when they seek medical care. Introduces feminist science theories and contemporary as well as historical examples to trace the evolution of "scientific truth" and its impact on the U.S. cultural landscape. Offers students the opportunity to question assumptions about science and view the scientific process as a site for critical analysis.

**Attribute(s):** NUpath Difference/Diversity

**HIST 1232. History of Boston. (4 Hours)**

Explores the history of Boston from colonial times to the present, with attention to the topographical growth and the ethnic composition of the city. Includes visits to historical sites, museums, and archives in the area.

**Attribute(s):** NUpath Interpreting Culture

**HIST 1246. World War II in the Pacific. (4 Hours)**

Studies World War II, the most devastating war in history, which began in Asia and had a great long-term impact there. Using historical and literary texts, examines the causes, decisive battles, and lingering significance of the conflict on both sides of the Pacific.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 1252. Japanese Literature and Culture. (4 Hours)**

Explores major works of Japanese fiction and poetry in historical and cultural context. All readings are in English translation.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**HIST 1253. History of Vietnam Wars. (4 Hours)**

Presents a history of military conflicts on the Indochinese Peninsula from its precolonial settlement; internal developments and divisions; its stormy relationship with China; French colonization and the resistance to it; the rise of the Vietminh during World War II; the postwar struggle against the French; the impact of the cold war; and the involvement of the United States after 1950 in the creation of two Vietnams and in the conflict that engulfed it and its neighbors, Laos and Cambodia, in the decades that followed. Emphasizes the roles of nationalism and communism in the 20th-century conflicts and the motives for U.S. intervention. Films revealing the reactions of Americans to the escalating conflict are shown and evaluated.

**HIST 1261. Global Caribbean. (4 Hours)**

Focuses on the culture and history of Caribbean societies in global perspective. Explores Caribbean creativity and resilience across English, French, and Spanish linguistic and political spheres with examples from literature, art, music, food, technology, and performance. Considers the global reach of Caribbean diasporas, highlighting the long local histories of Caribbean communities in Boston. Follows four key themes—indigeneity, blackness, diaspora, and creolization—to understand this unique point of entry for the study of race, gender, and sexuality in the Americas.

**HIST 1270. Ancient Greece. (4 Hours)**

Studies the Greek achievement from proto-Indo-European migrations through the Minoan and Mycenaean bronze age, to the evolution of Homeric and Hellenic societies in the iron age, to the rise of the city-states and the age of Alexander. Topics include the coexistence of the rational and the irrational; the paradox of ethical philosophies and exclusionary political systems; the tensions between particularism and cultural unity; and gender ideology and what has been termed "the reign of the phallus."

**HIST 1272. Europe in the Middle Ages, 500–1500. (4 Hours)**

Examines the history of medieval Europe in a period of tremendous fluidity, migration, and flux. Studies the experiences of men and women in European societies before clearly defined nation-states had emerged. Topics include forms of political and cultural integration; the contacts between Europeans and non-Europeans in the Mediterranean and beyond; and the place of religion, art, and ideology, with attention to how Europeans' experiences varied according to their gender, class, and race.

**Attribute(s):** NUpath Interpreting Culture

**HIST 1286. History of the Soviet Union. (4 Hours)**

Examines Russia and the Soviet Union in the 20th century focusing on empires and revolutions: the Russian empire's dissolution, the Russian Revolution and civil war, building the Soviet Union, World War II, the cold war and Soviet expansion in Eastern Europe and Asia, the breakup of the Soviet Union and its newly independent states, and Russian efforts to maintain influence in the post-Soviet space. Assesses the construction of Soviet identity by interpreting Soviet culture in the form of film, literature, art, and music. Evaluates explanatory theories of revolution and empire and the evolution of Marxism in the context of revolution and state building.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**HIST 1290. Modern Middle East. (4 Hours)**

Examines the political, social, and cultural history of the Arab countries of the modern Middle East, as well as Iran, Israel, and Turkey. Covers the period from the early 19th century through the late 20th century. Offers students an opportunity to obtain a basis for understanding the politics, social movements, and cultural expressions of the region in the late 20th century. Major themes include imperialism and colonialism; the creation and transformation of the modern states and their political systems since World War I; the transformation of Middle Eastern societies during this same period under the impact of colonialism, independence, regional wars, and oil; women's and labor movements; and revolutions. Uses a variety of sources including memoirs, photography, literature, and political speeches.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 1294. History of the Jews in the Modern World. (4 Hours)**

Surveys the history of the Jews in the modern world, with an emphasis on global cultural exchange. Examines Jewish interaction with non-Jewish society from Europe to North Africa, the Middle East, the Soviet Union, Israel, and the United States; and explores this relationship's creative and destructive consequences. Focuses on how Jewish society, culture, religious practice, and political definition changed in relation to a variety of processes now associated with modernity, such as urbanization, industrialization, state centralization, and the development of nationalism and secularism.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 1300. Introduction to Health and Humanities. (4 Hours)**

Explores the ways in which narrative and other forms of creative and cultural expression help shape conceptions of illness, healing, and the body. Offers students opportunities to consider the health and humanities through a variety of interdisciplinary perspectives and genres. Includes small-group and classwide experiential field outings. Culminates in the composition of reflective responses, a medical ethics/medical journalism piece, and a team-based experiential e-portfolio project. Course objectives include differentiating between healing and curing; knowing how to elicit, listen to, and analyze stories to determine how participants in the healthcare system experience illness and healing; being able to articulate the ways health is a cultural construct; and using this analysis to identify an empathic response as a future professional.

**Attribute(s):** NUpath Interpreting Culture

**HIST 1357. Data, Surveillance, and Society. (4 Hours)**

Explores the history of data in the United States. Considers the laws, technologies, and politics that have surrounded data's collection and uses, with special emphasis on data surveillance and privacy. Analyzes how data collection has influenced state power, labor and business, law enforcement, political campaigns, race and gender, media, public health, computing, and personal identity. Provides historical context for evaluating and analyzing contemporary issues around digital data and its applications.

**Attribute(s):** NUpath Societies/Institutions

**HIST 1389. History of Espionage 1: Antiquity to World War II. (4 Hours)**

Explores the history of espionage through a series of case studies from ancient Rome, Greece, and China; the Reformation; the Age of Discovery; the French Revolution; the American Civil War; World War I and the Russian Revolution; and World War II. Commonly referred to as the world's "second oldest profession," espionage is an intrinsic part of the relationships between communities, institutions, and states. Draws from a wide variety of published and unpublished primary and secondary sources, supplemented by modern theoretical and social science perspectives, literature, and films.

**Attribute(s):** NUpath Societies/Institutions

**HIST 1390. History of Espionage 2: Cold War Spies. (4 Hours)**

Explores the history of espionage during the Cold War era (1943–1991) through a series of case studies. Draws from a wide variety of published and unpublished primary and secondary sources, supplemented by modern theoretical and social science perspectives, literature, and films. Students work individually and in teams to explore the history of covert operations, including the following subthemes: the origins of the Cold War in World War II, the postwar battle for German scientists, containment and rollback, Venona and code breaking, nuclear spies, defectors, proxy wars, insurgencies and counterinsurgencies, terrorism, and technology.

**Attribute(s):** NUpath Societies/Institutions

**HIST 1500. Modern China. (4 Hours)**

Introduces modern Chinese history and culture through literary works, films, and historical texts. Examines political, social, and cultural changes in China since 1800: the decline of empire; the New Culture Movement of the 1920s; the rise of nationalism and rural revolution; the changing roles of women; the Cultural Revolution of the 1960s; and China's cinematic, literary, and economic engagement with the world since 1978. Taught in English and open to all undergraduates. CLTR 1500 and HIST 1500 are cross-listed.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**HIST 1575. Natural Disasters in World History. (4 Hours)**

Analyzes the history of natural disasters, focusing on the 1500s to the present. Offers training in methods of environmental, economic, political, and cultural history to address historical research questions about how people have tried to anticipate hazards, develop new tools for risk management, build infrastructures for relief, expand government capacity for disaster response, and remember victims.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**HIST 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HIST 2000. Native American Resistance: Past and Present. (4 Hours)**

Introduces the Indigenous peoples of North America and the academic field of Native American and Indigenous studies. Combines public history and public art, field trips, and original research to focus on the ongoing resistance to colonization and erasure and the resilience of Indian nations in New England and beyond. Covers particular themes, including the present-day impact of historical treaties and policies including land allotment, relocation, termination, boarding schools, and natural resource extraction.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**HIST 2011. Capitalism and Business: A Global History. (4 Hours)**

Analyzes the emergence of capitalism as a global system, from the emergence of early modern market societies to today's globalization and its discontents. Considers how technological and geopolitical developments changed the economic lives of people around the world and how those people responded. Examines historical debates about ethics of redistribution and economic justice. Topics include empire and slavery, industrialization and deindustrialization, moral economy and market societies, and finance and speculation, as well as the histories of money, commodities, and consumer cultures. Sources include historical scholarship, archive documents, economic philosophy, and cultural production such as novels, music, and art.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**HIST 2025. Latin American History through Film. (4 Hours)**

Uses films to analyze major questions in Latin American history. Topics include conquest, slavery, and revolution. The films are works of fiction, but most of them relate to real events. Course readings include "traditional" primary sources about the events (such as letters and espionage reports). Studies the history represented in the films and the assumptions and ideological perspectives and how these are conveyed through narrative and visual techniques. More broadly, considers how history is presented and represented by different sources. Offers students an opportunity to obtain a deeper appreciation for the complexity of Latin America.

**Attribute(s):** NUpath Interpreting Culture

**HIST 2101. Law and Religion in Israel. (4 Hours)**

Examines how religious diversity features in Israeli life, society, and laws. Israel maintains a unique form of legal pluralism in regulating its official religious communities and their courts. Considers how Israeli society, its religious and civil courts, and its government navigate the challenges that Israel faces as a self-defined "Jewish and democratic state" with a legal commitment to the religious autonomy of its officially recognized religious communities. Explores the complex interplay between religion and law in the daily life of Israel's citizens.

**HIST 2211. The World Since 1945. (4 Hours)**

Examines the political, economic, social, and cultural relationship between the developed and developing world since the end of World War II. Topics include the Cold War, independence and national movements in developing countries, the globalization of the world economy, scientific and technological innovations, wealth and poverty, the eradication of some diseases and the spread of others, the fall of the Soviet Union, Middle East turmoil, and the enduring conflict between Israel and Palestine.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 2217. The Global Far-Right since 1945: Politics, Culture, Violence. (4 Hours)**

Explores the emergence of far-right activism globally since the end of World War II. Emphasizes how radical far-right ideology developed and shifted over the course of the last 75 years by focusing on how it globalized through written culture, music, and the internet. Examines a number of case studies in which far-right cultures developed and then spread, which can include South Africa, the United States, the United Kingdom, and Russia, as well as related movements such as radical Hindu nationalism and Hindutva. Explores each case study in terms of culture, politics, and ideologies of violence.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**HIST 2220. History of Technology. (4 Hours)**

Offers an interdisciplinary survey of the global history of science and technology. Explores how scientific and technical knowledge, processes, and innovations developed and circulated. Examines how science and technology both shaped and responded to society, culture, ethics, and thought.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 2233. The History of Medicine in North America. (4 Hours)**

Surveys the history of medicine in what is now the United States between the arrival of European explorers in the 16th century and the end of World War II. Introduces exemplary moments in the history of medicine as it is practiced today, and examines how these histories connect to the experience of the dispossessed, the enslaved, and the economically and culturally marginalized in American history. Encourages students to consider how the history of medicine has been written both by historians and practitioners and to see this history not only as a series of events, places, and people but as a method for opening up American history more broadly.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**HIST 2280. Hitler, Germany, and the Holocaust. (4 Hours)**

Studies historical developments from Germany's defeat in World War I to the end of World War II. Topics include the failure of Weimar democracy; Weimar culture; the rise to power of Hitler and National Socialism; Nazi culture and racial wars against alleged "degenerates"; the roles of party leaders, business and cultural elites, and ordinary Germans in supporting and legitimizing the Nazi dictatorship.

**Attribute(s):** NUpath Societies/Institutions

**HIST 2282. The Holocaust and Comparative Genocide. (4 Hours)**

Examines the origins of the Holocaust, perpetrators and victims, and changing efforts to come to terms with this genocide. The Holocaust, the murder of six million Jews by Germans in Nazi-occupied Europe during World War II, is one of the crucial events of modern history. Investigates the uniqueness of the Holocaust relative to other acts of ethnic cleansing or genocide, including mass death in the New World and mass murder in Armenia, Bosnia, and Rwanda.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**HIST 2285. America and the Holocaust. (4 Hours)**

Examines the American response to the Holocaust, in terms of both contemporaneous knowledge and actions and the lasting impact on policy and culture. Starts with early twentieth-century events, such as the Armenian genocide, that shaped later attitudes. Explores the prewar period, particularly U.S. immigration and isolationist policies. Assesses Americans' knowledge of European events as the extermination campaign unfolded and fights ensued over rescue possibilities. Examines changing depictions of the Holocaust that emerged in the postwar period as a result of critical events such as the Eichmann trial and popular television and film portrayals. Finally, considers how perceptions of the Holocaust have shaped subsequent U.S. responses to genocide. HIST 2285, JRNL 2285, and JWSS 2285 are cross-listed.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**HIST 2299. Uses and Abuses of History: Historical Reasoning in U.S. Global and Domestic Policy. (4 Hours)**

Studies how historical information influenced decision making in the United States during four policymaking episodes of the post-World War II era: the confrontation with the Soviet Union during the Cold War; the expansion of the welfare state during the 1960s; the war in Vietnam; and the Reagan "revolution." Focuses on decisions made by policymakers as these four episodes evolved. Analyzes why decision makers did what they did; what extent they were guided by their understanding of history; how accurate their historical information was; and how usefully they applied their historical understanding to the situation at hand.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**HIST 2301. The History Seminar. (4 Hours)**

Introduces history majors to advanced techniques of historical practice in research and writing. Offers students an opportunity to conduct original research and write an original research paper. Seminar themes vary; students should check with the Department of History for a list of each year's seminar offerings. May be repeated without limit.

**Prerequisite(s):** HIST 1201 with a minimum grade of D-

**Corequisite(s):** HIST 2302

**HIST 2302. Historical Writing. (1 Hour)**

Covers learning and practicing methods and conventions of historical writing for publication. Adjuncted to a Seminar in History, which fulfills the Advanced Writing in the Disciplines requirement.

**Prerequisite(s):** HIST 1201 with a minimum grade of D-

**Corequisite(s):** HIST 2301

**HIST 2303. Gender and Reproductive Justice. (4 Hours)**

Introduces the social, legal, and economic barriers to accessing reproductive healthcare domestically and internationally. Draws on various theoretical and analytic tools including critical race theory, critical legal theory, sociology of science, human rights, feminist theory, and a range of public health methods. Access to reproductive health services, including abortion, is one of the most contested political, social, cultural, and religious issues today. Covers domestic, regional, and international legal and regulatory frameworks on sexual reproductive health. HIST 2303, SOCL 2303, and WMNS 2303 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 2306. The World in a Decade: The 1990s. (4 Hours)**

Examines the political, economic, and social dynamics of the first post–cold war decade. Topics include the geopolitical aftermath of the cold war, democracy and development in developing countries, the globalization of the world economy and its impacts, the rise of nationalism, genocide, the rise of China as an economic power, and the varieties of Islamic movements.

**HIST 2308. Law, Justice, and Society in Modern China. (4 Hours)**

Offers an overview of the historical development and function of law in Chinese society from the late imperial era to today and in comparison with other bodies of jurisprudence. Reading a wide range of scholarly articles and monographs, the course looks at "law" beyond jurisprudence and legal codes to examine its changing relationship with social customs, political institutions, religious traditions, popular culture, family and gender relations, and economic exchanges.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions, NUpath Writing Intensive

**HIST 2311. Colonialism/Imperialism. (4 Hours)**

Examines the military, economic, political, and cultural expansion of world powers since the fifteenth century, and the ways in which colonized peoples were ruled. Why did colonialist countries feel the need to conquer and dominate, how did they do it, and why did they retreat on some fronts? How did people resist and cooperate with colonialism? How did colonialism affect national and cultural identities? Colonialism is examined as a global phenomenon and from a comparative perspective that looks at particular case studies. Also examines decolonization in the twentieth century.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 2318. New England Stories: Storytelling and the African American Experience. (4 Hours)**

Delves into the fascinating stories of African Americans who have called New England home, from the seventeenth century up to the present. Discusses themes such as freedom and slavery, migration, and civil rights. Introduces an interdisciplinary framework for understanding Black identity formation, activism, and cultural as well as intellectual traditions amid the long struggle for justice.

**Prerequisite(s):** ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**HIST 2330. Colonial and Revolutionary America. (4 Hours)**

Covers the discovery and exploration of the New World, the settlement of the English, French, Dutch, Swedish, Spanish, and Russian colonies on the North American mainland, their development to 1763, the origins of their clashes with England, and the American Revolution.

**HIST 2337. African American History Before 1900. (4 Hours)**

Traces the presence of African-descended people in North America. Emphasizes the historical and cultural links between Africa and North America that have shaped the Black experience in the United States. Explores and analyzes the institution of slavery, the role of free Black communities, the Civil War and emancipation, and Black leadership and protest during the Reconstruction era. Introduces students to the historian's craft, theoretical debates concerning race and gender, and the persistence of the past in the present.

**Prerequisite(s):** ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**HIST 2351. Modern Japan. (4 Hours)**

Examines state formation, economic growth, imperialism and colonialism, war and defeat, and contemporary culture.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**HIST 2360. History of Capitalism in East Asia. (4 Hours)**

Traces capitalism's transformation of economic life in East Asia from the early modern era to the contemporary world. Explores changes in the human participation of production, exchange, and consumption. Reading a wide range of scholarly articles and monographs, the course examines key topics, including the great divergence debate, commodification of labor, consumer cultures, birth of industrialization, resilience of family enterprises, gender and the economy, and the role of the developmental state.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 2370. Renaissance to Enlightenment. (4 Hours)**

Covers the social, economic, political, and cultural transformations of Europe from the Renaissance to the French Revolution. Traces the rebirth of Catholic Europe from 1300; the Reformation; the religious wars; struggles over religious and scientific beliefs; advances in technology, science, and warfare; overseas expansion; the scientific revolution; and the Enlightenment.

**HIST 2373. Gender and Sexuality in World History. (4 Hours)**

Introduces key concepts in the fields of gender and identity studies as they apply to world history since about 1800. Offers students an opportunity to understand the critical significance of gender, sex, sexuality, and identity to world events and how these contentious subjects influence the contemporary world. Surveys a series of major movements in geopolitics, labor, economics, culture, and society in order to analyze how individual and group identities, as well as mass assumptions about behavior and performance, have shaped these events. Gender, sex, and sexuality are integral to class discussions of work, welfare, art, culture, violence, war, and activism. HIST 2373 and WMNS 2373 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**HIST 2375. The Tudors, the Stuarts, and the Birth of Modern Britain. (4 Hours)**

Examines the history of early modern England as well as Ireland, Wales, and Scotland. Follows the development of England from a small backwater to one of the most powerful European nations by the end of the seventeenth century. Analyzes the constantly shifting relationships between the various cultural identities within Britain. Concentrates on British history not only from the perspective of the elites but also the ordinary people whose names have often been lost to history. Key themes include the growth of the British Empire, issues of gender, the interactions between England and the Celtic fringes, and participation in the political franchise.

**HIST 2376. Britain and the British Empire. (4 Hours)**

Traces the rise of Britain as a major colonial power and its transformation after the end of empire. Explores the interrelationships between metropole and colonies through sustained attention to critical race, feminist, and socioeconomic frameworks. Units include colonial violence, settler colonialism, anticolonial resistance, decolonization, multicultural Britain in the postcolonial era, and relations with the European Union.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 2388. World War II in Eastern Europe. (4 Hours)**

Presents an overview of World War II in Eastern Europe using primary sources. Emphasizes how ideology, propaganda, and preexisting ethnic tensions shaped the war. Examines Nazi and Soviet war aims and the dramatic escalation in ferocity toward opposing armies and civilians after 1941. Considers the scale and nature of the Holocaust in the east; factors contributing to collaboration and resistance; and how gender, class, and ethnicity affected wartime experiences. Analyzes the contribution of World War II to the subsequent Cold War.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 2390. Africa and the World in Early Times. (4 Hours)**

Examines the place of Africa in the world from 1000 C.E. to the mid-19th century. Investigates the histories of ancient Egypt, the savannah and forest regions of West Africa, coastal and interior East Africa, and southern Africa. Explores the rise of medieval city-states and empires, the activities of the Atlantic slave trade and the trans-Saharan and Indian Ocean slave trades, debates over mass migration and the spread of language groups, the rise of agriculture, the development of nonstate political structures, the growth of trading societies, and the development of new cultural forms. Links Africa's early histories to current debates about the role of history in contemporary politics and to present understandings of Africa's historical place in world affairs.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**HIST 2430. Digital Histories of Ethnic Boston. (4 Hours)**

Integrates history of ethnic groups in Boston with methods from the digital humanities (DH) through a semester-long collaborative student project focused on one particular ethnic group. Combines learning how to use DH technology (as well as its possible misuses) with learning about the history of particular ethnic groups in Boston, such as Jews, the Irish, African-Americans, etc. Uses hands-on approaches to study ethnic migration and history to and within Boston by touring neighborhoods and sites. Examines DH technologies through workshops introducing tools such as Omeka, Story Maps, and Tableau, among other possibilities. Also examines different techniques for data visualization, relationship mapping, network analysis, and text analysis.

**Attribute(s):** NUpath Analyzing/Using Data

**HIST 2431. Immigration and Identity in the American Jewish Experience. (4 Hours)**

Examines Jewish political, social, and cultural history from the arrival of the first group of Jews at New Amsterdam in 1654 to the present. Themes include immigration, adaptation, family life, religion, anti-Semitism, Zionism, the Holocaust, and American-Israeli relations.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HIST 2991. Research Practicum. (2-4 Hours)**

Involves students in collaborative research under the supervision of a faculty member. Offers students an opportunity to learn basic research methods in the discipline. Open to students with freshman standing with permission of instructor. May be repeated once for up to 4 total credits.

**HIST 3305. Beyond the Binary: Race, Sex, and Science. (4 Hours)**

Considers how gender, race, and sexuality have been treated in science, focusing primarily on the 19th and 20th centuries. Examines the history of ideas about gender, race, and sexuality as reflected in fields such as biology, psychology, endocrinology, and neuroscience. Discusses contraceptive and reproductive technologies, pharmaceutical trials, the gendering of scientific professions, and recent studies that use algorithmic predictions of sex or sexual orientation. Uses close reading techniques and discussions to advance student expertise.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HIST 3310. War and Society. (4 Hours)**

Focuses on the history of the relationship between war, the military, and society. Interrogates militarism, asking why people have chosen—or have been chosen—to fight and die, or why and how they have protested and resisted. Analyzes how war has been presented and consumed in popular culture and how societies have conceived of “wartime” and “peacetime.” Emphasizes four key themes—race, gender, sex, and class—to track developments in military practice and administration alongside political processes, and considers how the military reflects and is reflected in society.

**Attribute(s):** NUpath Societies/Institutions

**HIST 3330. The Global Cold War. (4 Hours)**

Examines the Cold War, emphasizing how the Soviet-American struggle for global preeminence intersected with decolonization and the rise of the “Third World.” Uses primary sources, monographs, and scholarly articles to trace the major events and developments of the Cold War—ideological differences between the capitalist and socialist systems, the Cuban Missile Crisis, the construction of the Berlin Wall, the Vietnam War—while also exploring how and why the Cold War came to pervade economic, cultural, and social relations globally. Examines how unexpected actors—Cuban doctors and Peace Corps volunteers—responded to and shaped superpower rivalry. Considers how the Cold War continues to shape the world today.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions, NUpath Writing Intensive

**HIST 3333. Showcasing the World: Museums in History and Practice. (4 Hours)**

Examines the social, cultural, and political history of museums and exhibitions around the world over the past 500 years. Focuses on the formation of the modern museum with the goal of illuminating contemporary museums' contributions and controversies. Offers special emphasis upon the history of U.S. museums. Topics include museum collecting and collections; governance; the influence of nationalism and colonialism; cultural heritage, property, and repatriation; museums' historical and present roles in education and exhibition; past and present understandings of curators, visitors, and communities; museum architecture; the impact of digitization on museum collections and exhibitions, visitor access and institutional strategy; contemporary efforts in decolonization and community building. Regular field trips to local museums are required.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**HIST 3334. Assassinations in World History. (4 Hours)**

Explores the historical antecedents to the unprecedented use of assassination and targeted killing as state policy in the current war on terror. the theory, strategic use, ethics, and legality of assassination. Using film, literature, and primary and secondary readings, explores case studies in the world history of assassination, from ancient times to the current day, including case studies from the Roman Empire, early modern Europe, revolutionary Europe, and the 20th century.

**Attribute(s):** NUpath Societies/Institutions

**HIST 3340. Technologies of Text. (4 Hours)**

Examines innovations that have reshaped how humans share information, e.g., the alphabet, the book, the printing press, the postal system, the computer. Focuses on debates over privacy, memory, intellectual property, and textual authority that have historically accompanied the rise of new media forms and genres. Offers students an opportunity to gain skills for working with texts using the rapidly changing tools of the present, e.g., geographic information systems, data mining, textual analysis.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Creative Express/Innov, NUpath Integration Experience

**HIST 3344. The History of Western Public Health. (4 Hours)**

Examines the rise of public health as a discipline and as an institution dedicated to monitoring and improving the health of specific populations. Studies key historical texts in the history of public health and medicine from Europe, Canada, and the United States, as well as European and American empires and colonies throughout the world. Emphasizes the importance of new techniques of state data gathering and analysis, including statistical methods, epidemiology, and state censuses. Considers how public health has increased state intervention in the daily lives of citizens and subjects and where and why resistance to these measures arose.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**HIST 3350. Leaders and Leadership in History. (4 Hours)**

Explores the classic historical question of whether leaders make history or history makes leaders. Some leaders are considered unquestionable successes, while others are deemed partial or abject failures. Examines how certain men and women arrived at leadership positions, considering personal charisma and historical contingency. Studies the choices leaders made in difficult situations, and analyzes leaders' successes and failures through historical notions of ethics and justice. Also examines the question of legacy, to understand why some leaders stand out (for better or worse) and other leaders recede from historical narratives. Case studies from around the world include national leaders and unsung heroes, from the early modern period through the present. Sources include historical scholarship, archive documents, and cultural renderings.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**HIST 3400. The Making of the Modern City. (4 Hours)**

Combines urban history, spatial history, environmental history, and cultural history. Focuses on cities and their inhabitants from the 18th century to the present. Covers topics such as modernization debates, globalization, national capitals and nation-states, women in the city and gendered uses of urban space, contested cities, cities at war, the city and its natural environment, and some of the main challenges facing cities today. Larger themes include urban design and ideology; resistance, rebellions, and social movements in the city; exclusion and inclusion and spatial segregation; violence and the city; the production and contestation of urban heritage; and the production of space.

**Attribute(s):** NUpath Societies/Institutions

**HIST 3470. Jews, Christians, and Muslims in Spain and Morocco: History and Memory. (4 Hours)**

Explores the intertwined histories of Jews, Christians, and Muslims in what is now Spain and Morocco. Focusing on the 8th to the 16th centuries, considers what characterized the societies, cultures, religions, and politics of the empires, kingdoms, and city-states that rose and fell in the southwestern Mediterranean and Atlas Mountains. Emphasizes the uses of history and the memory of religious coexistence by different groups living in Spain and Morocco today. Uses primary and secondary sources to gain an understanding of the complexities of interreligious conflict and cultural hybridity.

**HIST 3973. Topics in History. (4 Hours)**

Covers special topics in history, selected by the instructor. May be repeated twice.

**HIST 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HIST 4701. Capstone Seminar. (4 Hours)**

Offers students an opportunity to make use of advanced techniques of historical methodology to conduct original research and write a major, original research paper as the culmination of their work toward the history degree. This is a capstone research and writing seminar for history majors.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**HIST 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**HIST 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** HIST 4970 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**HIST 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HIST 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**HIST 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**HIST 4994. Internship in World History. (4 Hours)**

Offers a formal internship at the World History Resource Center for preservice teachers of history during the fall semester of the fourth year. Students read curriculum units prepared by other teachers and develop at least one substantial, multilesson unit of world history curriculum, under supervision of a history faculty member and in consultation with a practicing teacher. Fulfills experiential education requirement. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**HIST 5101. Theory and Methodology 1. (4 Hours)**

Examines the following questions in the context of major issues in current historical research and debate. Where do historical questions come from, and how do we answer them? How do we produce knowledge about historical events and processes? What theoretical models guide historians work? Emphasizes interdisciplinary approaches as well as concrete techniques in historical research. Required of all first-year graduate students.

**HIST 5102. Theory and Methodology 2. (4 Hours)**

Continues HIST 5101. Offers an advanced exploration of the theories and methods used by historians to develop students' ability to understand and critique the work of other historians. Emphasis is on theories and methods in world history, such as comparative models, systemic approaches, and focus on interconnections. Explores what it means to have a local, national, or global perspective, and how world history fits in with other fields of historical scholarship. Required of all PhD students.

**Prerequisite(s):** HIST 5101 with a minimum grade of C- or HIST 5101 with a minimum grade of D-

**HIST 5237. Issues and Methods in Public History. (4 Hours)**

Examines and analyzes major issues and methods in public history in the United States and the world. Topics include the nature and meaning of national memory and myth, the theory and practice of historic preservation, rural and land preservation and the organizational structures and activities associated with those efforts, the interrelationship of historical museums and popular culture, the history and organization of historic house museums, historical documentary filmmaking, historical archaeology in world perspective, interpreting "ordinary" landscapes, and the impact of politics on public history.

**HIST 5240. Feminist Resistance. (4 Hours)**

Engages students in the study of a variety of forms of feminist resistance in recent history, emphasizing the United States in the context of cross-cultural examples. Examines key feminist texts and manifestos and studies feminist activism in coalition with other social movements. Students identify and analyze unique features of gender-based activism in itself and in its intersections with other social movements, including movements and activism focused on race, class, sexuality, and physical ability.

**Attribute(s):** NUpath Societies/Institutions

**HIST 5241. Exhibits and Museums. (4 Hours)**

Considers the history of museums and exhibitions from a transnational perspective in order to examine the various roles museums have played in historical and contemporary global culture. Explores museums as cultural institutions and institutional cultures through historical and theoretical readings, museum visits, and the development of students' own exhibitions. Currently among the world's most popular sites of education and leisure, museums have held a wide range of social, political, and cultural roles over the past 500 years. Offers students an opportunity to develop more acute insight into the ways museums and their exhibitions have made and reflected ideas about history, science, art, identity, and culture.

**HIST 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**HIST 6955. Co-op Work Experience Abroad – Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated without limit.

**HIST 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HIST 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated twice.

**Corequisite(s):** INSH 6864

**HIST 6965. Co-op Work Experience Abroad. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated without limit.

**HIST 7221. Topics in World History. (4 Hours)**

Offers readings on selected themes and issues in world history. May be repeated without limit.

**HIST 7239. Space and Place. (4 Hours)**

Examines the role of space and place in the constitution of society and culture through a set of key readings. Themes include the geographical production of class, gender, and race/ethnicity in modernity and postmodernity as well as the role of space and place in debates around postcolonialism. The ways in which space and place are implicated in the practice of power and resistance are key to the course.

**HIST 7250. Topics in Public History. (4 Hours)**

Offers readings, class work, and projects on selected themes and issues in public history.

**HIST 7251. Topics in American History. (4 Hours)**

Focuses on one or more topics in the history of the United States. May be repeated up to two times.

**HIST 7314. Research Seminar in World History. (4 Hours)**

Gives students the opportunity to do research and write a paper that addresses historical issues and processes significant at a global scale. Discussions focus on what it means to be significant on a global scale, how to find and utilize relevant source material, and on previous scholarship relevant in helping shape questions and issues in our own work. Students also read and critique one another's work. May be repeated up to four times.

**HIST 7370. Texts, Maps, and Networks: Readings and Methods for Digital History. (4 Hours)**

Introduces the methods and practice of history in a digital age. Offers students an opportunity to see the wide variety of work being done computationally by historians and other humanists today and to obtain the background to be creative producers of new work and critical consumers of existing projects. The rise of computing technology and the Internet has the potential to reshape all parts of historical practice, from curation to research to dissemination. Examines the historian's craft in three primary domains: the creation of digital sources, the algorithmic transformations that computers can enact on cultural materials like texts, and the new ecologies of publishing and scholarly communication made possible by new media.

**HIST 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HIST 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

**HIST 8409. Practicum in Teaching. (1 Hour)**

Offers students the opportunity to teach individual college-level courses within the Department of History under the general supervision of a senior faculty member. Open to doctoral students.

**HIST 8410. Fieldwork in History 1. (2 Hours)**

Offers students the opportunity to get practical experience in historical agencies including historical societies, archives, museums, exhibits, restorations, preservation projects, and the like. Requires students to work in the agency ten hours a week for one semester under the direction of an agency supervisor and departmental adviser. May be repeated once.

**HIST 8411. Fieldwork in History 2. (4 Hours)**

Gives students a second opportunity to acquire practical experience in an historical agency. Requires ten hours a week for one semester under the direction of an agency supervisor and a departmental adviser.

**HIST 8960. Exam Preparation—Doctoral. (0 Hours)**

Intended to show full-time status during the semester of the PhD qualifying exam. Students are expected to carry a full load of research and/or teaching responsibilities in addition to this course. May be repeated three times.

**HIST 8982. Readings. (1-4 Hours)**

Offers selected readings under the supervision of a faculty member. May be repeated without limit.

**HIST 8984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**HIST 8986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**HIST 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**HIST 9990. Dissertation Term 1. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** HIST 9000 with a minimum grade of S

**HIST 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** HIST 9990 with a minimum grade of S

**HIST 9996. Dissertation Continuation. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** HIST 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## History - CPS (HST)

**HST 1100. History of the World 1: Prehistory to the Renaissance. (3 Hours)**

Examines the key factors and events that shaped world history from its earliest recordings to the age of the Renaissance. Analyzes history from a thematic and geographic perspective, examining the major moments in the ancient, medieval, and early modern periods. Studies how these periods in history led to the modern era.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**HST 1200. American History 1: Precontact to the Civil War. (3 Hours)**

Examines American history from the precolonial period up to the end of the American Civil War. From the time of the earliest settlers through the Civil War, religious, ethnic, racial, and cultural differences were important factors in the development of the U.S. as a pluralistic democracy. The important role played by these many differences are explored as students analyze history from social, cultural, and political perspectives and examine key moments and turning points in American history.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HST 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HST 2125. 20th-Century World Wars. (3 Hours)**

Examines the major causes, events, and outcomes of World War I and World War II. Analyzes the period of history prior to World War I to discover the causes of the Great War and then studies the end of the war and the events of the interwar period as a pretext for World War II. Offers students an opportunity to learn how the events of history from 1914–1945 shaped the world we live in today.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HST 2150. The World Since 1945. (3 Hours)**

Examines major historical events since 1945. Analyzes the political, social, cultural, and economic relationship between the developed and developing world as a backdrop for major moments in history since the end of World War II. Major topics include the end of World War II, the Cold War, decolonization, the fall of the Soviet Union, the Middle East, and the role of nationalism and globalization in recent historical events. Emphasizes the role of difference—ethnic, racial, gender, religious, etc.—in determining the geopolitical reality.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HST 2425. Coming to America: The American Immigrant Experience. (3 Hours)**

Examines the migration of people to North America. Analyzes the migration of Native Americans in ancient times, the arrival of European settlers and explorers, and the various waves of immigration to the United States from Europe, Africa, Asia, and Latin America. Emphasizes the diverse cultures that came, their reasons for coming, their reasons for settling in particular places, and the processes by which they resolved issues relating to "Americanization."

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HST 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HST 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HST 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**HST 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HST 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## History - CPS Specialty (HSTY)

**HSTY 1130. Introduction to American History. (3,4 Hours)**

Introduces students to major topics in American history using some combination of primary documents, biographies, monographs, and film. Topics include the interaction of native populations with European settlers; the American Revolution and the Constitution; slavery; the Civil War; the rise of industrialism and immigration; the growth of government and rise of the welfare state; race, gender, and class in America; and America's role in the world from the emergence of imperialism to collective security.

## Homeland Security - CPS (HLS)

**HLS 6000. Introduction to Homeland Security. (3 Hours)**

Offers an overview of the essential ideas that constitute the emerging discipline of homeland security. Seeks to expand the way students think, analyze, and communicate about homeland security and to assess knowledge in critical homeland security domains. Includes critically exploring strategy, history, terrorism, fear management, crisis communication, leadership, weapons of mass destruction, lessons learned, civil liberties, intelligence and information, homeland security technology, and analytics.

**HLS 6010. Contemporary Threats to Homeland Security. (3 Hours)**

Introduces the operational and organizational dynamics of terrorism and other threats facing the United States today. Considers those who act as individuals, in small groups, or in large organizations and indigenous actors, as well as those who come to the United States to raise money, recruit, or commit their acts of violence. Focuses on violent clandestine activity that, whatever its motivation, has a political purpose or effect. Addresses specific topics such as suicide terrorism, the role of the media, innovation and technology acquisition, and ways of measuring the effect of counterterrorism policies and strategies.

**HLS 6020. Technology for Homeland Security. (3 Hours)**

Offers individuals involved in homeland security a broad overview of homeland security technology, information systems, inspection and surveillance technology, communication, knowledge management, and information security. Government agencies in today's information age are more dependent than ever on technology and information sharing. Focuses on technology as a tool to support homeland security personnel regardless of functional specialty. The methodology used in the course frames technology in terms of its contribution to deterrence, preemption, prevention, protection, and response after an attack.

**HLS 6030. Intelligence for Homeland Security. (3 Hours)**

Examines key questions and issues facing the U.S. intelligence community and its role in homeland security. The September 11, 2001, terrorist attacks on the World Trade Center and Pentagon and the ensuing war on terror have focused the nation's attention on homeland security. Addresses policy, organizational, and substantive issues regarding homeland intelligence support. Course reference materials provide an overview of diverse intelligence disciplines and how the intelligence community operates. Emphasizes issues affecting policy, oversight, and intelligence support to homeland security and national decision making. Covers the 2004 Intelligence Reform and Prevention of Terrorism Act and focuses on homeland intelligence support issues at the state/local/tribal levels.

**HLS 6040. Critical Infrastructure and Protection. (3 Hours)**

Focuses largely on protecting the most fundamental critical infrastructures, one of the cornerstones of homeland security. Develops a network theory of vulnerability analysis and risk assessment called "model-based vulnerability analysis," which is used to extract the critical nodes from each sector and then applying fault and financial risk-reduction techniques to derive the optimal strategy for protection of each sector. At the completion of the course, students should be able to apply the model-based vulnerability technique to any critical infrastructure within their multijurisdictional region, derive optimal strategies, and draft policies for prevention of future terrorist attacks.

**HLS 6060. Strategic Planning and Budgeting. (3 Hours)**

Examines a resource management system that allows decision makers to see the long-term implications of the decisions they are making today. Homeland security requires programs in such disparate areas as counterterrorism, information security, border security, counterdrug activities, etc. It also requires coordination of programs at the federal, state, and local levels. Covers how decision makers at the various levels decide which of these programs should be funded, the size approved programs should be and how they fit together, and how plans are translated into budgets. Studies an analytic approach to allocating resources in order to provide maximum security with limited budgets.

**HLS 6070. Emergency Management and Geographic Information Systems. (3 Hours)**

Explores how emergency management activities can best utilize geographic information technologies (GIT) to solve real-world issues in emergency management. This includes planning and response for both natural disasters and man-made events (accidental and terror-related incidents). Through the use of a variety of tools and analytical techniques, demonstrates and explores the nexus between emergency management and GIT. Exposes students to an understanding and appreciation for that relationship as well as the tools and skills for appropriate utilization of them.

**HLS 6080. Continuity of Operations and Planning. (3 Hours)**

Seeks to enable students to develop and implement continuity of operations (COOP) plans. COOP is a federal initiative, required by presidential directive, to ensure that executive branch departments and agencies are able to continue to perform their essential function under a broad range of circumstances. Today's changing threat environment and recent emergencies have increased the need for COOP capabilities and plans. Topics include what COOP is and why it is important; how COOP differs from continuity of government (COG); the roles and responsibilities of key players in COOP planning; and family support measures to take in case of COOP implementation.

**HLS 6150. Essentials of Emergency Management. (3 Hours)**

Examines the hazards and phases in emergency management and planning. Includes all levels of public and private sector involvement in discussing the definition of emergencies and disasters, both natural and man-made, and the issues involved with managing situations. Examines frameworks such as the National Preparedness System; the National Incident Management System; and others for organizing, responding, and mitigating crises from an all-hazards, all-threats perspective, including both U.S. and international concerns. Offers students an opportunity to learn a comprehensive understanding of the U.S. emergency management system; how communities mitigate against, respond to, and recover from all disaster events; as well as the U.S. involvement for international disaster response contingencies.

**HLS 6155. Critical Infrastructure, Security, and Emergency Management. (3 Hours)**

Examines real-world critical infrastructure protection and emergency response to analyze and assess the essential points of protection and prevention combined with emergency response mechanisms for natural and man-made crises. Examines policy, programs, and management of critical infrastructure risk and protection in the context of emergency management and planning for the varying levels of public and private sector involvement. Uses the 16 Critical Infrastructure Sectors as a basis of examining the collaborative responses and complex interactions at all levels of government for today's emergency management concerns. Uses frameworks such as the National Preparedness System, the National Incident Management System, and others to analyze emergency management processes and examples of historical critical infrastructure threats, failures, and incidents.

**HLS 6160. Advanced Emergency Management. (3 Hours)**

Evaluates real-world disaster scenarios for planning and response to prepare students for roles within the continuum of emergency management and planning. Examines cases and contingencies involving various types of threats and hazards to communities, business, and organizations using a scenario-based approach. Offers students an opportunity to analyze, critique, and develop planning strategies based on existing real-world contingencies using Department of Homeland Security (DHS) and the Federal Emergency Management Agency (FEMA) guidelines for U.S. protection and resilience for communities and organizations. Emphasizes assessing the threats, risks, and vulnerabilities of communities, infrastructure, and organizations, enabling students to plan for and develop strategic assessments for all-hazards, all-threats scenarios within the National Preparedness System.

**HLS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HLS 6983. Topics in Homeland Security. (1-4 Hours)**

Introduces selected and substantive issues in homeland security. Topics vary from one offering of the course to the next. May be repeated up to seven times for up to 8 total credits.

**Prerequisite(s):** HLS 6000 with a minimum grade of C- ; HLS 6010 with a minimum grade of C- ; HLS 6020 with a minimum grade of C- ; HLS 6030 with a minimum grade of C- ; HLS 6040 with a minimum grade of C- ; HLS 6050 with a minimum grade of C-

**HLS 7990. Thesis. (1-4 Hours)**

Offers thesis supervision by members of the department.

**Prerequisite(s):** HLS 6010 (may be taken concurrently) with a minimum grade of C ; HLS 6020 (may be taken concurrently) with a minimum grade of C ; HLS 6030 (may be taken concurrently) with a minimum grade of C ; HLS 6040 (may be taken concurrently) with a minimum grade of C ; HLS 6050 (may be taken concurrently) with a minimum grade of C ; GST 6109 (may be taken concurrently) with a minimum grade of C

**Honors Program (HONR)****HONR 1102. Honors Discovery. (1 Hour)**

Offers students an opportunity to take full advantage of the John Martinson Honors Program and to foster a sense of community within the first-year honors experience. Students explore the goals of the program through a variety of experiential learning activities such as taking part in a theme-based living/learning community, learning through an interdisciplinary perspective, advancing their global mindset, and making an impact in the communities that they inhabit. Required for all first-year honors students.

**HONR 1310. Honors Inquiry. (4 Hours)**

Designed to provide an honors introductory-level experience. Draws upon an interdisciplinary perspective to expand individual knowledge and facilitate a deeper understanding of issues. Similar to a topics course, each section of the course offers a new and unique academic experience. May be repeated without limit.

**HONR 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HONR 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HONR 2991. Research and Creative Endeavors in Honors. (1-4 Hours)**

Offers University Honors students an opportunity to conduct research and creative endeavors under faculty supervision. Requires the permission of instructor and University Honors Program. May be repeated two times for a maximum of 12 semester hours.

**HONR 2992. Research and Creative Endeavors. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors performed under faculty supervision. Requires the permission of instructor and University Honors Program. May be repeated nine times.

**HONR 3309. Honors Seminar Abroad. (4 Hours)**

Seeks to promote knowledge, understanding, and global engagement through course work, language acquisition, travel, and participation in a Northeastern University designed and delivered international academic experience. Targeted toward honors students who may not have the opportunity to complete international work later on in their academic career or who want to have an early international experience prior to a more traditional study abroad or international co-op experience. May be repeated without limit.

**HONR 3310. Honors Seminar. (4 Hours)**

Designed to provide an honors intermediate-level experience. Draws upon an interdisciplinary perspective to expand individual knowledge and facilitate a more advanced understanding of issues. Emphasizes research and inquiry of urban, historical, or contemporary themes. May be repeated up to nine times.

**HONR 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HONR 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HONR 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of the department on a chosen topic. Course content depends on instructor. Requires Honors Program participation. May be repeated without limit.

**HONR 4997. Honors Interdisciplinary Thesis. (4 Hours)**

Represents a culmination of the diverse topics students encounter while enrolled in the University Honors Program. Offers students an opportunity to work closely with a faculty mentor to conduct intensive original research that includes an interdisciplinary perspective and produces a significant body of work. The thesis should utilize a cross-discipline perspective that includes at least two disciplines, allowing students to express their academic creativity, to discover new ways of synthesizing information, and to test the traditional boundaries between disciplines.

**HONR 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Human Resources Management (HRMG)

### **HRMG 6200. Managing People and Organizations. (3 Hours)**

Examines today's evolving environment, in which effective utilization of human resources is a source of competitive advantage. To maximize the contribution of organizational members, managers must be able to understand, diagnose, and influence workplace behavior in the context of change. Topics include management of cross-functional teams and boundaryless organizations. Emphasis is on the role of corporate culture and distributed leadership.

### **HRMG 6217. Virtual, Vicious Teams: Building and Leading High-Performance Teams. (3 Hours)**

Offers an opportunity to learn how to build and lead different types of teams, including co-located, virtual, global, and top management teams. Asks students to identify the roles and responsibilities of team members and leaders and to develop effective communication, collaboration, and commitment among team members and other constituencies. Also examines how to effectively facilitate coordination across functionally distinct teams.

**Prerequisite(s):** HRMG 6200 with a minimum grade of C- or HRMG 6208 with a minimum grade of C-

### **HRMG 6218. Great Companies. (3 Hours)**

Studies and debates the criteria for a great company. As suppliers, customers, employees, or students, everyone has experience with a range of organizations. Some are admired, some are mediocre, and some are dreadful. This course focuses on companies with management practices that produce and sustain extraordinary outcomes such as low cost, amazing service, fast growth, and exceptional quality. Often, these companies are great because they dare to be different and the key question is: "How do they do it?" Explores such topics as organizational culture, organizational design, empowerment, business process improvement, reward systems, and employee and organizational learning. Uses a variety of learning approaches, including case studies, articles, lecture/discussion, videos, and exercises.

**Prerequisite(s):** HRMG 6200 with a minimum grade of C- or HRMG 6208 with a minimum grade of C- or HRMG 6318 with a minimum grade of C-

### **HRMG 6220. Health Organization Management. (3 Hours)**

Covers key issues and introduces management principles in health organization management. Offers students an opportunity to apply important theoretical ideas, such as systems thinking and organizational learning, to meet challenges effectively, to learn how the healthcare workplace functions, and how to manage in these workplaces. Emphasizes case-based learning, critical thinking, and evidence-based management using individual and group projects. Introduces cutting-edge tools in areas such as work redesign, performance management, brand enhancement, and quality improvement. Addresses the management imperatives of today's healthcare organizations and how to implement strategies and programs to meet those imperatives effectively. Intended for anyone interested in working or managing within the healthcare industry, including the field of public health.

### **HRMG 6221. Power and Influence. (3 Hours)**

Introduces students to the uses of power and influence in the surroundings in which they work, working with and managing people, and achieving the goals they set for themselves. Offers students an opportunity to make sense of their own on-the-job learning experiences and to explore basic diagnostic and action-planning skills that they can later use on the job. Exposes students to a variety of cases that demonstrate the effective and ineffective uses of power in different types of organizational contexts and at different points in a manager's career and how to consider difficult ethical questions as well.

### **HRMG 6222. The Entrepreneurial Mindset of Leaders. (3 Hours)**

Examines the entrepreneurial mindset: the relationship between successful business leadership and the psychological techniques and characteristics that thriving entrepreneurs possess. Studies the interpersonal and interactional side of building impactful ventures that matter and provide value, drawing from a mix of live cases and experiential exercises. Introduces a conceptual foundation and offers practical tools for addressing situations that students are likely to face in entrepreneurship and in leadership roles.

### **HRMG 6223. Global Talent Management. (3 Hours)**

Offers students an opportunity to obtain the insights, frameworks, and tools to effectively manage and develop talent in teams and organizations. Also explores promotion and cross-functional systems that strengthen the organization as well as retention strategies to promote and reward high-quality talent. Managing and developing talent is one of the top three issues on the minds of CEOs from around the world. In fact, CEOs cite managing and developing their leadership talent as the issue that is most important to the future success of their business but that their organizations are least capable of addressing effectively. Offers students an opportunity to engage in various activities intended to illustrate and practice the skills involved in implementing talent management systems.

**HRMG 6230. Leading a Diverse and Inclusive Organization. (3 Hours)**

Examines issues including discrimination and bias, sexual harassment and workplace romance, professional and personal development, power and privilege, work and family, and organizational strategies for promoting equal opportunity and a multicultural approach for leveraging diversity and inclusion. Incorporates readings to generate lively discussions and debates, experiential learning, self-reflection, case studies, and guest speakers who are diversity experts and thought leaders. Diversity in the workplace involves recognizing and capitalizing on individual differences such as religion, gender, race, ethnicity, sexual orientation, national origin, age, and physical ability/disability. Leaders need to address issues of diversity in strategic and ethical ways if they are to compete and succeed in a global economy.

**HRMG 6260. Advanced Topics in Human Resource Management. (3 Hours)**

Offers an in-depth examination of selected issues and problems in human resource management that are of current interest to faculty and students. Specific topics alternate depending on faculty availability and interest as well as student enrollment criteria. May be repeated once.

**Prerequisite(s):** HRMG 6200 with a minimum grade of C- or HRMG 6208 with a minimum grade of C-

**HRMG 6280. The Human Side of Innovation. (3 Hours)**

Examines the leadership and managerial skills required for effectively managing multifunctional teams engaged in product, service, and business process innovation. Incorporates fieldwork, corporate visits, and other experiential learning opportunities. Explores strategies for recruiting, motivating, and retaining high-performance people. Introduces models for leading systematic innovative change within established corporate cultures, including understanding senior management attitudes toward innovation and how to create executive sponsors and mentors.

**HRMG 6318. Managing the Organization. (2 Hours)**

Offers key insights every business professional should understand working in, managing, and leading organizations in today's complex, diverse, and dynamic business environment. The primary goal of this course is to challenge—and improve—students' understanding of human behavior in organizations so that they are better positioned to strategically leverage human capital. Introduces critical theories and concepts through case analyses, debates, TED Talks, and exercises that aim to help students understand, analyze, and ultimately address real business situations and problems.

**HRMG 6423. Global Talent Management. (4 Hours)**

Offers students an opportunity to obtain the insights, frameworks, and tools to effectively manage and develop talent in teams and organizations. This experiential learning course uses simulation and gamification to introduce students to the building blocks organizations use to manage the performance of individuals and teams. Students work in teams to create a work environment that enables employees to thrive by exploring the significant facets of talent management. Classroom discussions draw from case studies, podcasts, and current industry articles to focus on developing core competencies such as identifying, assessing, and developing talent to deliver performance coaching for individuals and teams and drive employee engagement and retention.

**HRMG 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HRMG 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

**Human Resources Management - CPS (HRM)****HRM 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HRM 2320. Human Resources Management. (3 Hours)**

Examines and applies principles, practices, and current issues facing organizations as related to attracting, selecting, motivating, and keeping the most talented organizational members in today's competitive environment. Focuses on human resource management strategy, organizational staffing, employee and labor relations, and organizational safety and security. Emphasizes current legal considerations and issues.

**Prerequisite(s):** MGT 1100 with a minimum grade of D- or HMG 1100 with a minimum grade of D-

**HRM 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HRM 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HRM 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated up to four times for a maximum of 20 semester hours.

**HRM 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HRM 6005. Creating a High-Performance Organization: Strategic Organizational and HRM Choices. (3 Hours)**

Covers the choices that are critical and central to a growing organization and the role that HRM plays in the decision-making process. As our global and domestic environments grow more complex, organizations seeking excellence are faced with a myriad of strategic choices, and many of those choices are the responsibility of the HR manager. Major topics include motivation, perception, interpersonal communication, leadership, power and influence, decision making, group dynamics, team building, corporate culture, and socialization. Offers students an opportunity to learn how to motivate employees and create a team-based culture of support, learning, and renewal. Emphasizes the practical application of specific skills, theories, and concepts that empower students to become effective HR managers and leaders in their organizations.

**HRM 6010. Compensation and Benefits. (3 Hours)**

Examines how organizations determine their merit and incentive plans, wage and salary structures, and compensation methods to give students a close-up look at team-based reward systems, flexible benefits plans, and indirect compensation. Designing the right mix of compensation and benefits is critical to attracting and retaining quality employees. Explores innovative ways to construct and manage the compensation and benefits mix.

**HRM 6015. Introduction to Human Resources Management. (3 Hours)**

Introduces students to the scope, vocabulary, and strategic environment of a rapidly evolving field. Examines the range of competencies that contribute to effective human capital management in support of organizational performance. Topics include human resources strategy, talent acquisition, performance management, and compensation and benefits.

**HRM 6020. Talent Acquisition and Onboarding. (3 Hours)**

Underscores the importance of linking recruitment goals with overall company strategy. Finding and hiring the right people is often cited as the number-one concern of businesses. Topics include approaches to job design, market analysis, recruiting and selecting employees, leveraging social media and hiring analytics to ensure better-quality hires, and effective onboarding practices.

**HRM 6025. Workforce Analytics. (3 Hours)**

Examines the characteristics of high-quality data, key workforce metrics, and introduces common analysis techniques. Human resources management helps drive business performance by delivering competitive advantage through people. This requires a solid grasp of HR analytics: the systematic collection, analysis, and interpretation of data designed to improve decisions about talent and the organization as a whole.

**Prerequisite(s):** HRM 6015 with a minimum grade of C-

**HRM 6030. The Employment Contract. (3 Hours)**

Examines the legal relationship between employer and employee. Students will explore issues and topics such as discrimination, affirmative action, the Americans with Disabilities Act, sexual harassment, health and safety, AIDS in the workplace, compliance issues, and legal issues related to downsizing and terminations. Human Resource managers work in a highly complex environment with constantly changing laws and legislation that govern employee rights and employer obligations.

**HRM 6035. Digital Human Resources Platforms. (3 Hours)**

Explores the changes in organizational HR design that have produced a shift from transactional processes to an employee-focused experience. Offers students an opportunity to examine how integrative HR platforms and data analytics help HR leaders create process, deliver policy, and communicate with employees in real time through cloud-based software and mobile applications throughout the employee life cycle.

**Prerequisite(s):** HRM 6015 with a minimum grade of C-

**HRM 6036. Digital Human Resources Lab. (1 Hour)**

Offers students an opportunity to develop a more in-depth understanding of current and emerging technology applications that may be leveraged by the human resources function to address key business needs and transformation objectives. Examines, through further demonstrations/examples, how integrative digital HR platforms/applications can help HR leaders transform their function and create business value.

**HRM 6042. Strategic Workforce Planning. (3 Hours)**

Explores the development of talent management programs required to effectively execute corporate strategy. Effective workforce planning and implementation are essential to the maintenance of an organization's competitive advantage and the successful execution of organizational strategy. Reviews topics in human resource planning, gap analysis, overcoming implementation barriers, and promoting the change process.

**Prerequisite(s):** HRM 6025 with a minimum grade of C-

**HRM 6047. Managing the Employee Life Cycle. (3 Hours)**

Explores the best practices across a range of sectors in order to enable HR professionals to play the role of business partners with key organizational stakeholders. One of the primary responsibilities of HR professionals is managing talent throughout the employee life cycle in order to enhance employee productivity and career growth. Topics covered include performance management, retention strategies, training and development, and succession planning.

**HRM 6060. Organizational Design. (3 Hours)**

Focuses on organizational design with special emphasis on innovative organizational forms that can provide strategic advantage. Topics include structuring and staffing HR functions, workspace design, and structural options for entire organizations, from startups to mature global companies. Explores leading-edge innovations, such as crowd-based organizations, internal resource markets, and other forms of collective intelligence.

**HRM 6070. Global Human Resources Management. (3 Hours)**

Explores the trends in workforce globalization and their implications for effective human resources management. Topics include intercultural competencies, cultural adaptation, global mobility, and a comparative examination of human resource policies and practices in major global markets. Students explore the skills and knowledge required to manage talent in multinational organizations.

**HRM 6072. Global and Comparative Employment/Employee Relations. (3 Hours)**

Focuses on institutional, organizational, and managerial perspectives of employment processes, relationships, and outcomes in a globalized economy. Examines cross-national variation in employment relations and labor law through the lens of convergent-divergent HRM theory. Other topics include global and national labor standards and rights, mechanisms through which labor is governed, ways in which workers are organized, as well as cultural and social factors that impact international employment.

**Prerequisite(s):** HRM 6070 with a minimum grade of C-

**HRM 6074. Global Talent Acquisition and Mobility. (3 Hours)**

Focuses on organizational staffing issues that are not present in a domestic environment or that increase in complexity in an international context. Examines ethnocentric, polycentric, regiocentric, and geocentric approaches to managing and staffing international subsidiaries. Other topics include the varied types of international assignments; selection criteria and procedures for the same; the roles of expatriates, nonexpatriates, and inpatriates; as well as management, motivation, development, and repatriation of workers on international assignments.

**Prerequisite(s):** HRM 6070 with a minimum grade of C-

**HRM 6400. Employee Engagement. (3 Hours)**

Explores the cognitive, affective, and behavioral dimensions of employee engagement in supporting organizational performance. Research demonstrates that high levels of employee engagement contribute to high levels of productivity and innovation, as well as low turnover. Topics include the different dimensions of engagement, the design and interpretation of surveys, trust and transparency, diversity and inclusion, and best practices in employee engagement in a range of sectors.

**HRM 6940. Projects for Professionals. (4 Hours)**

Offers students an opportunity to apply knowledge and skills gained through their master's program to challenging short-term projects under faculty supervision. Matches students with discipline-specific consulting projects provided by a wide range of sponsoring organizations in the private and nonprofit sectors. Students develop a project plan, conduct research, develop and deliver recommendations to the sponsoring organization, and reflect on lessons learned. Mapping human resources management competencies and skills to the consultative process is a primary learning outcome. As the capstone, this course should be the last course taken. Students with less than two years of professional experience must successfully complete a noncredit Experiential Learning project before registering for the capstone course.

**Prerequisite(s):** HRM 6015 with a minimum grade of C ; HRM 6025 with a minimum grade of C ; HRM 6042 with a minimum grade of C

**HRM 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HRM 6980. Capstone. (3 Hours)**

Offers students an opportunity to integrate their course work, knowledge, and experiences into a capstone project.

**HRM 6995. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

## Human Services (HUSV)

**HUSV 1000. Human Services at Northeastern. (1 Hour)**

Intended for first-year students in the College of Social Sciences and Humanities. Introduces students to liberal arts; familiarizes them with their major; develops the academic skills necessary to succeed (analytical ability and critical thinking); provides grounding in the culture and values of the University community; and helps to develop interpersonal skills—in short, familiarizes students with all skills needed to become a successful university student.

**HUSV 1101. Social Change and Human Services. (4 Hours)**

Offers students an opportunity to obtain a foundation for understanding social inequality and for practicing in the human services field. Introduces students to a range of specializations in the area of human services through lectures, service-learning, group work, individual projects, papers, debates, and presentations. Analyzes and applies ethical frames for practice using case studies and service-learning experiences. Additionally, students are expected to develop an understanding of the history of nonprofit and government responses to inequality and the social, political, and economic forces that influence social professionals.

**Attribute(s):** NUpath Integration Experience, NUpath Societies/Institutions

**HUSV 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HUSV 2200. Psychological First Aid. (1 Hour)**

Introduces the fundamentals of PFA, or Psychological First Aid, to students new to postdisaster work. PFA is the practice of recognizing and responding to the mental health of people experiencing crisis-related stress in the short-term aftermath of a disaster. This stress can impact people's physical, mental, psychological, and spiritual well-being. Explores the ways in which the evidence-based practice of PFA can help people increase their resilience and recover from the impact of psychological trauma. Offers students an opportunity to develop skills for responding in the aftermath of a variety of crises including pandemics, accidents, robberies, suicide, homicide, and community violence. Also offers students a foundation in crisis intervention theory. Students engage in case studies, role-plays, critical incident reviews, journals, and an examination.

**HUSV 2300. Counseling in Human Services. (4 Hours)**

Presents an overview of the major theoretical approaches to counseling and therapeutic interventions. Focuses on developing clinical skills and competency in intentional interviewing. Combines systemic group exercises and experiential activities to practice interviewing techniques. Cross-cultural issues in counseling are integrated throughout the course.

**Prerequisite(s):** (ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C); (HUSV 1101 (may be taken concurrently) with a minimum grade of C or PSYC 1101 (may be taken concurrently) with a minimum grade of C )

**Attribute(s):** NUpath Difference/Diversity, NUpath Writing Intensive

**HUSV 2320. Techniques in Individual and Group Counseling. (4 Hours)**

Presents an in-depth exploration of clinical practice with individuals and groups. Focuses on the development of practice skills through simulation-based learning, presentations, case studies, and reflective inquiry. Examines complex topics in clinical practice including boundaries, rupture and repair, and cultural humility. Introduces postmodern techniques and interventions used with individuals and groups in a variety of settings. Emphasizes cross-cultural applications and work with historically marginalized populations.

**Prerequisite(s):** HUSV 2300 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity

**HUSV 2340. Mindfulness in Mental Health. (4 Hours)**

Explores mindfulness and its relationship to human services. Mindfulness is practiced in myriad human services settings, including schools, mental health facilities, medical settings, and prisons. Traces the development of mindfulness from its origins in Buddhism, to early adoption and integration with Western mental health ideologies, to the ways it is currently being integrated in social service organizations. Explores the inherent tensions in adopting a practice embedded in ancient non-Western cultures to Western thinking, healing, and psychotherapy. Examines the ways culture, identity, and power have shaped the presentation and proliferation of mindfulness.

**Attribute(s):** NUpath Interpreting Culture

**HUSV 2355. Race, Identity, Social Change, and Empowerment. (4 Hours)**

Examines racism, racial identity, and theories of social change and racial empowerment primarily within the U.S. context. Highlights different ways in which racism and racial privilege have been experienced by different racial communities, more specifically at the micro-, meso-, and macro-levels. Offers students an opportunity to learn ways to promote racial empowerment and equity. Using theory from primarily psychology and sociology, the course investigates the impact of social systems and institutions on individual-level and group experiences of racism. Investigates students' own racial identities, a deeper understanding of institutional inequalities and intersectionality, and practical skills in leadership and community building that can promote positive social change and racial equality.

**Prerequisite(s):** ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity

**HUSV 2370. Restorative Justice: Transforming the System. (4 Hours)**

Explores the roots of restorative justice and locates contemporary examples of its application in various settings in the United States and the world. Examines its utility in addressing the mass incarceration crisis and the current penal system and mode of punishment in the United States. Students practice and apply critical race and systems theories to use a systems lens to examine the impact of racism, sexism, gender discrimination, and other systems of oppression on behavior and the justice system.

**Attribute(s):** NUpath Integration Experience

**HUSV 2401. Food Justice and Community Development. (4 Hours)**

Uncovers and examines the key dilemmas of the food system in the United States today using readings, media, discussion, service-learning, and field trips. Working from the foundations of environmental justice and community development, covers production, access, distribution, and key stakeholders from producers to retailers, workers, and consumers. Considers what justice-related issues face stakeholders within the food system in the United States; what policies have most impacted the workforce in the American food system; and what the opportunities and leverage points are for change in improving justice outcomes in this system.

**Attribute(s):** NUpath Integration Experience

**HUSV 2440. Expressive Therapy. (4 Hours)**

Examines foundational practices and theory in expressive therapies. Considers the ways that expressive therapies are used in clinical and community-based settings as a tool to improve well-being and mental health. Explores expressive modalities such as the visual arts, performing arts, movement, music, and creative writing. Special attention is given to contemporary topics including trauma, human development, and social and economic inequalities. Considers the application of expressive therapies in different settings, such as schools, hospitals, residential programs, and prisons.

**Attribute(s):** NUpath Creative Express/Innov

**HUSV 2500. Science of Play. (4 Hours)**

Examines the scholarship of play. Explores the role and function, benefits, and barriers of play in child development. Topics include the background and significance of play in history; the role of play as a predictor of academic and social functioning; and the use of play in character/moral development and to prevent, intervene, and treat trauma. Explores clinical and nonclinical implications of play, as well as the physiological and social implications of play, using contemporary research on brain science and development. Combines classroom learning with fieldwork experiences throughout the local Boston community and independent research on the role of play as prevention, intervention, and treatment. Students develop service-based research projects with community partners to address key questions related to the science of play.

**Attribute(s):** NUpath Integration Experience, NUpath Societies/Institutions

**HUSV 2800. Sexual Orientation and Gender Expression. (4 Hours)**

Introduces students to efforts among social and nonprofit organizations working to reduce heterosexism, homophobia, and transphobia in institutions, communities, and the society as a whole. Discusses practice across the life span for social professionals (social workers, counselors, advocates, and educators) in varied settings such as criminal justice, mental health, adoption, adult day health, and residential programs. Applying theories and current scholarship on LGBTQQ identity development, social movements, media, and advocacy, offers students an opportunity to evaluate contemporary issues of controversy for institutions, social practitioners, and policy. HUSV 2800 and WMNS 2800 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity

**HUSV 2850. Sexual Politics and the Practice of Sexuality Education. (4 Hours)**

Uses interdisciplinarity and theory-based approaches to study the interplay between sexual politics and the fields comprising human services. Considers contemporary and historical paradigms of sexual health as they both reflect and shape politics, social inequality, cultural ideologies, and individual health and wellness. Incorporates strategies from sociology, social work, public health, and the education fields—as well as theoretical foundations from feminist, gender, queer, inequality, and prevention studies—to inform examination of social change embedded in professional practice.

**Attribute(s):** NUpath Societies/Institutions

**HUSV 2960. Intercultural Studies through Human Services. (4 Hours)**

Examines the social, political, and economic forces that influence how nongovernment organizations develop and operate in settings abroad. Compares predominant theoretical and philosophical orientations for poverty reduction and social impact. Students analyze and compare popular preventative and reactive interventions for change such as public health approaches, the use of aid, microlending, philanthropic funding, and sustainable development organizations. This intensive, integrated course applies lectures, presentations, case studies, meetings with local stakeholders, and service-learning.

**Attribute(s):** NUpath Difference/Diversity, NUpath Integration Experience, NUpath Societies/Institutions

**HUSV 2970. Research Methods for Human Services. (4 Hours)**

Offers an introduction to social science research that examines the theoretical and ethical foundations of social research methods. Highlights foundation knowledge and skills in hypothesis testing, research design, sampling strategies, measurement techniques, and basic data analysis and interpretation. Focuses on program evaluation to provide an opportunity for students to link social science research methods to direct human service practice.

**Prerequisite(s):** HUSV 1101 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**HUSV 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HUSV 3200. Introduction to Art Therapy. (4 Hours)**

Explores the intersection of art and therapeutic practices, emphasizing the role of creative expression in promoting emotional and psychological well-being. Introduces foundational concepts in art therapy, including historical development, theoretical frameworks, and applications across diverse populations and settings. Examines how artistic processes foster self-awareness, resilience, and the therapeutic process. Provides an opportunity to analyze case studies and contemporary approaches, emphasizing cultural humility and ethical considerations in practice. Designed for students interested in the therapeutic potential of art in clinical, educational, or community-based environments.

**Attribute(s):** NUpath Creative Express/Innov

**HUSV 3300. Principles and Practices of Trauma-Informed Care. (4 Hours)**

Explores trauma-informed practices at individual, organizational, and systemic levels. Critically analyzes the history, theoretical frameworks, and current body of literature in the field of trauma-informed care. Examines trauma-informed treatment approaches in counseling and case management, emphasizing historically marginalized populations. Considers ethical and legal frameworks related to the experience of trauma and evaluates social policy and issues of social injustice. Students participate in experiential learning activities and problem-based learning to demonstrate and apply knowledge acquired throughout the course.

**Attribute(s):** NUpath Difference/Diversity

**HUSV 3520. Child Intervention and Treatment. (4 Hours)**

Compares and contrasts primary, secondary, and tertiary levels of intervention as they pertain to child welfare systems. Topics include child development, impacts of poverty on development, child maltreatment, educational inequality, disability, play, and community violence. Examines the availability, distribution, effectiveness, and efficiency of universal and targeted interventions in the home, school, and community. Offers students an opportunity to study current events, case studies, and documentaries as sources to connect social and psychological theory, research, and promising practices in child development.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**HUSV 3540. Substance Use and Social Justice. (4 Hours)**

Analyzes the intersections of substance use with forms of oppression from a social justice harm reduction lens. Presents the complex interactions of biological, psychological, and social determinants of health as they relate to substance use and misuse. Explores the nature, etiology, and treatment of substance use disorders and how they relate to the health and human services field. Offers students an opportunity to obtain the requisite foundation knowledge of, and skills in, evidence-informed substance use prevention, education, and treatment with individuals, groups, families, organizations, and communities.

**HUSV 3570. The Nonprofit Sector, Philanthropy, and Social Change. (4 Hours)**

Offers students an opportunity to explore the nonprofit sector's multifaceted role in U.S. society and its relationship to democracy and social change. Introduces theoretical and practical frameworks for examining contemporary models of nonprofit and philanthropic practice and examines the ethical implications of engaging in and funding activities designed to effect social change. Offers students an opportunity to apply these concepts by mapping the complex systems within which social challenges emerge and by making real dollar grants to local nonprofit organizations.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**HUSV 3580. Sexual Violence: Counseling, Programs, and Policy. (4 Hours)**

Offers an in-depth examination of sexual violence, its effects, and the resources available to assist survivors. Presents an overview of the criminal justice, medical, legal, and counseling systems and the impact these interweaving systems have on survivors. Offers students an opportunity to develop crisis counseling competency through group exercises and experiential activities. HUSV 3580 and WMNS 3580 are cross-listed.

**HUSV 3900. Social Policy. (4 Hours)**

Examines how social policy influences child, family, and community development. Provides a historical overview and a contemporary examination of many social problems, including poverty, health and mental health issues, child welfare, educational inequality, and consequences of juvenile and adult crime. Examines the policies and programs that help or hinder positive individual, family, and community development and considers the role of human service values and ethics on the American response to social policy. Offers students an opportunity to examine and critique the implementation or lack of implementation of formal social policies at the local, state, and federal level and to suggest initiatives to meet the needs of intergenerational families.

**Attribute(s):** NUpath Societies/Institutions

**HUSV 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HUSV 4700. Senior Seminar in Human Services. (4 Hours)**

Examines emerging roles and career options within the human services field. Focuses on self-examination of attitudes and values affecting delivery of services, exploration of ethical issues and dilemmas relevant to human services, grant and funding issues, staff supervision and development within human services agencies, and refinement of group leadership skills.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**HUSV 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**HUSV 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** HUSV 4970 with a minimum grade of D-

**HUSV 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HUSV 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**HUSV 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**HUSV 4994. Human Services Internship. (6 Hours)**

Requires students to fulfill one internship placement during the last two years of the program. Consists of required field site hours and varies according to the students' interests. Examples of placement sites include community centers, nursing homes, vocational workshops, state and federal agencies for children, and recreational facilities. Experiences are supervised by internship supervisor to maximize the student's learning opportunities. Fulfills the experiential education requirement. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**Human Services - CPS (HSV)**

**HSV 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HSV 2200. Introduction to Clinical Practice. (3 Hours)**

Presents an overview of the major theoretical approaches to clinical practice. Offers students an opportunity to develop values, skills, dispositions, and competencies needed to serve a wide range of populations, particularly those who are vulnerable. Considers the influence of listening, emotional intelligence, interdisciplinary engagement, and cultural responsiveness on their work with clients.

**Prerequisite(s):** HSV 1100 with a minimum grade of D- or PSY 1100 with a minimum grade of D- or (PSY 1010 with a minimum grade of D- ; PSY 1210 with a minimum grade of D- ) or (PSY 1010 with a minimum grade of D- ; PSY 1410 with a minimum grade of D- ) or (PSY 1210 with a minimum grade of D- ; PSY 1410 with a minimum grade of D- )

**HSV 2240. Human Behavior in the Social Environment. (3 Hours)**

Offers students a foundation for understanding behavior as it applies within the context of dynamic human systems. Interactions with individuals, families, groups, organizations, and communities are at the core of practice. Explores the interrelationship between human development and behavior across the life span, focusing on the impact of surroundings such as culture, community, and social systems. Introduces research-oriented and practice-based perspectives to enhance students' development with regard to professional values, ethics, assessment, and intervention strategies. Emphasizes diverse and at-risk populations.

**Prerequisite(s):** SOC 1100 with a minimum grade of D- or PSY 1100 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**HSV 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HSV 3200. Techniques in Individual and Group Counseling. (3 Hours)**

Explores clinical practice with individuals, groups, and families. Focuses on developing 21st-century practice skills relevant in today's global social and health services market through a variety of classroom methods. Explores theoretical frameworks and their applications in a variety of settings. Emphasizes marginalized, vulnerable, and underserved populations.

**Prerequisite(s):** HSV 2200 with a minimum grade of D-

**HSV 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HSV 4950. Seminar. (1-4 Hours)**

Offers an in-depth study of selected topics.

**HSV 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HSV 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**HSV 6980. Capstone. (1-4 Hours)**

Provides students with an opportunity to complete a service-learning project. Covers how to conduct a community needs assessment of a community and how to develop skill and sophistication in assessing community strengths and identifying community needs. The final project requires drafting a program proposal and making policy recommendations.

**Prerequisite(s):** HSV 6100 with a minimum grade of C- ; HSV 6110 with a minimum grade of C- ; HSV 6120 with a minimum grade of C- ; HSV 6630 with a minimum grade of C- ; HSV 6640 with a minimum grade of C- ; HSV 6160 with a minimum grade of C-

**HSV 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**Industrial Engineering (IE)****IE 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**IE 2310. Introduction to Industrial Engineering. (4 Hours)**

Provides an overview of the history of industrial engineering and of the most common methods that industrial engineers use to solve problems and design efficient processes. The emphasis is on how these methods are used to study, improve, and/or optimize a product or process. Topics include work design, ergonomic design, engineering statistics, quality engineering, engineering economics, project management, and process optimization. Also discusses the design of the production processes, facilities, and material handling systems. Studies applications in manufacturing, product design, and service industries. Laboratory experiments and written reports are required.

**Prerequisite(s):** MATH 1340 with a minimum grade of D- or MATH 1341 with a minimum grade of D-

**Corequisite(s):** IE 2311

**Attribute(s):** NUpath Writing Intensive

**IE 2311. Recitation for IE 2310. (0 Hours)**

Provides small group demonstration and hands-on labs for IE 2310.

**Corequisite(s):** IE 2310

**IE 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**IE 3412. Engineering Probability and Statistics. (4 Hours)**

Presents probability theory axiomatically, with emphasis on sample space presentation of continuous and discrete random variables. Covers descriptive statistics, expected value of random variables, covariance and correlation, sampling distribution, and point and interval estimations. Introduces hypothesis testing including tests for means, variances, and proportions.

**Prerequisite(s):** MATH 1342 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**IE 3425. Engineering Database Systems. (4 Hours)**

Examines the representation of data and its creation and management in engineering enterprises. Discusses the client/server model of database access. Presents the fundamentals of data modeling and management, data mining and warehousing, multitier applications, and the use of the SQL query language. Emphasizes the use and applications of database systems in engineering including design and manufacturing. Topics include design schema of tables, records and fields of databases, SQL statements, security issues, and the use of a scripting language such as Perl or Visual Basic.

**Prerequisite(s):** GE 1111 with a minimum grade of D- or GE 1502 with a minimum grade of D-

**Corequisite(s):** IE 3426

**IE 3426. Recitation for IE 3425. (0 Hours)**

Provides small group demonstration and problem solving for IE 3425.

**Corequisite(s):** IE 3425

**IE 3500. Introduction to Healthcare Systems Engineering. (4 Hours)**

Introduces systems engineering methods in healthcare system applications for students who are not industrial engineering majors. Using principles drawn from operations research and industrial engineering, this course focuses on analysis, design, management, and control of health systems (e.g., hospitals, emergency departments, surgery departments, and outpatient clinics) and processes which are critical to the delivery of quality healthcare. Topics include an overview of queueing, simulation, data envelopment analysis, and spreadsheet modeling as applied to real-world healthcare problems such as staffing and scheduling, resource allocation, patient flow management, process improvement, and medical decision making.

**Prerequisite(s):** IE 3412 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or PHTH 2210 with a minimum grade of D- or MGSC 2301 with a minimum grade of D-

**IE 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**IE 4510. Simulation Modeling and Analysis. (4 Hours)**

Covers process model design and development, validation, and experimentation for discrete-event simulation models. Topics include problem formulation, data collection and analysis, random-variable generation, model development, scenario experimentation, statistical analysis of output, and resultant decision management. Utilizes a major industry-standard simulation software application with animation capabilities.

**Prerequisite(s):** (GE 1111 with a minimum grade of D- or GE 1502 with a minimum grade of D-); (IE 3412 with a minimum grade of D- or MATH 3081 with a minimum grade of D-)

**IE 4512. Engineering Economy. (4 Hours)**

Introduces students to economic modeling and analysis techniques for selecting alternatives from potential solutions to an engineering problem. Presents basic methods of economic comparison such as present worth, annual worth, rate of return, and benefit/cost techniques. Studies effects of taxes on investment analysis. Also covers decision tree analysis and statistical decision techniques.

**IE 4515. Operations Research. (4 Hours)**

Introduces deterministic models including linear programming; duality and postoptimality analysis; transportation and assignment problems; and network flow problems such as the shortest path, minimum spanning tree, and maximum flow.

**Prerequisite(s):** MATH 2341 with a minimum grade of D-

**IE 4516. Quality Assurance. (4 Hours)**

Reviews the distributions and statistical approximations commonly applied in statistical quality control methods. Introduces analysis of variance and simple linear regression. Covers basic principles to state-of-the-art concepts and application of statistical process control and design. Applies principles to a variety of products. Topics include product quality measures and controls, Shewhart control charts, quality cost, Pareto analysis, discrete and variable sampling, and military standards in quality control.

**Prerequisite(s):** IE 3412 with a minimum grade of D- or MATH 3081 with a minimum grade of D-

**IE 4520. Stochastic Modeling. (4 Hours)**

Covers the analytical development and solution to stochastic models in operations research. Topics include Markov chains, queuing theory, and dynamic programming.

**Prerequisite(s):** IE 3412 with a minimum grade of D- or MATH 3081 with a minimum grade of D-

**IE 4522. Human-Machine Systems. (4 Hours)**

Emphasizes and addresses human sensory and motor performance, information processing, learning and training methodology, skilled-task development, psychophysical models, response time, and relevant aspects of attention and memory. Topics include system design and development, hazard and error evaluation, and properties of effective visual displays. Endorses experimentation as a source of knowledge of human performance characteristics. Covers research and statistical analyses related to human-asset engineering, fundamentals of vision, audition, somesthesia, signal detection, and some aging effects. Safety and usability of environments, machines, products, and devices consider principles of human-machine interaction, decision making, and anthropometric characteristics. Laboratory experiences include literature review, experimental design, data collection and analysis, hypothesis testing, and generation of reports to inform the design of safe, usable, and marketable engineering products, processes, and systems.

**Prerequisite(s):** (IE 3412 with a minimum grade of D- or MATH 3081 with a minimum grade of D-); (ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C)

**Corequisite(s):** IE 4523

**IE 4523. Lab for IE 4522. (1 Hour)**

Accompanies IE 4522. Covers topics from the course through various activities.

**Corequisite(s):** IE 4522

**IE 4525. Logistics and Supply Chain Management. (4 Hours)**

Introduces the analysis, design, control, and operation of logistics and supply chain management systems. Includes the integration of supply chain components, logistics information systems, forecasting, production scheduling, inventory management, transportation and warehousing, and facility location planning.

**Prerequisite(s):** (IE 3412 with a minimum grade of D- or MATH 3081 with a minimum grade of D-); IE 4515 with a minimum grade of D-

**IE 4530. Manufacturing Systems and Techniques. (4 Hours)**

Focuses on manufacturing and design and their impact on each other. Covers the basics of design-manufacturing integration, manufacturing systems, manufacturing processes and techniques, manufacturing automation, and production planning and control. Topics include concurrent engineering, design for assembly, design for manufacturability, rapid prototyping, mechanical tolerancing, bill of materials, group technology, computer-aided process planning, NC part programming, programmable logic controllers, flexible manufacturing systems, computer-integrated manufacturing, and just-in-time philosophy. Topics also include traditional manufacturing processes such as casting, forming, machining, welding, molding, and particulate processing, and nontraditional manufacturing processes such as electrical discharge machining, laser machining, and water-jet machining. Students are required to conduct manufacturing-related experiments in the manufacturing lab to gain hands-on experience.

**Corequisite(s):** IE 4531

**IE 4531. Lab for IE 4530. (1 Hour)**

Accompanies IE 4530. Covers topics from the course through various activities.

**Corequisite(s):** IE 4530

**IE 4535. Human-Machine Systems in a Global Context. (5 Hours)**

Introduces human-machine systems in an international setting. Offers students an opportunity to travel to a foreign country to develop theoretical understanding while experiencing the issues and human factor considerations in a global environment. Topics include human performance, information processing, learning, memory; vision, visual performance, interface display design; audition, noise, hearing, and auditory signals; human anthropometric characteristics; and cognition, usability testing, and principles of human-machine interface design. Laboratory experiences include design of experiments, data collection, analysis, and laboratory reports generation. Includes a project that focuses on applications that allow students to delve into issues that affect engineering and technology development in their host country.

**Prerequisite(s):** (IE 3412 with a minimum grade of D- or MATH 3081 with a minimum grade of D- ); (ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C )

**IE 4625. Facilities Planning and Material Handling. (4 Hours)**

Explores engineering tools, techniques, and concepts for the design of facilities. The term facility is defined broadly. Industrial plants, schools, hospitals, or places in which things are produced or services are provided to a customer are all considered facilities. Provide students with a broad but practical understanding of the facilities planning and design process. The critical nature of material handling is discussed and approaches to designing optimal handling systems are examined. The tools of operations, research, statistical methods, and software applications are the focus of the problem-solving activities.

**Prerequisite(s):** IE 3412 with a minimum grade of D- or MATH 3081 with a minimum grade of D-

**IE 4699. Special Topics in Industrial Engineering. (4 Hours)**

Focuses on advanced industrial engineering project agreed upon between the student and instructor. May be repeated without limit.

**IE 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**IE 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated once.

**Attribute(s):** NUPath Integration Experience

**IE 5137. Computational Modeling in Industrial Engineering. (4 Hours)**

Builds computational models for industrial engineering applications. Offers students an opportunity to learn how to identify the problem, split it into subsystems, develop mathematical models of each sub-system, and implement in Python. Selected problems are specific to industrial engineering applications with examples of inventory systems, queuing systems, production planning and control, supply chain management, transportation, network flows, forecasting, scheduling, Monte Carlo simulation, regression analysis, sensitivity analysis, and decision support systems in data science and machine learning to test and learn from models. Students also have an opportunity to learn how to use Python libraries to implement the corresponding data structures and algorithms.

**Prerequisite(s):** GE 1111 with a minimum grade of D- or GE 1502 with a minimum grade of D- or graduate program admission

**IE 5200. Mathematics for Machine Learning. (4 Hours)**

Covers mathematical concepts essential for understanding machine learning algorithms. Builds foundational knowledge in linear algebra, analytic geometry, matrix decompositions, probability, optimization, and specific models such as Gaussian mixture models.

**Prerequisite(s):** (IE 3412 with a minimum grade of C- or IE 4515 with a minimum grade of C- or MATH 3081 with a minimum grade of C-) or graduate program admission

**IE 5360. Digital Manufacturing. (4 Hours)**

Presents a boot camp for programming in manufacturing through the lens of 3D printing and automation. Offers students an opportunity to develop a skill set in Python and PLC programming. Covers how to write in G-code, using Python to control CNC machines; writing 3D processing code; and making restful APIs for 3D printers. Introduces how to develop web-connected infrastructure useful for automation, as well as PLC programming to enable web-connected manufacturing systems, scaffolding knowledge from a math background in multivariable calculus.

**IE 5374. Special Topics in Industrial Engineering. (4 Hours)**

Offers topics of current interest in industrial engineering. May be repeated up to two times.

**IE 5380. Integrated Automation. (4 Hours)**

Incorporates the concepts needed to integrally run and manage a set of automated systems in a manufacturing environment. Reviews manufacturing systems and techniques, and characterizes core drives such as control systems, the required hardware (sensors and actuators), robotic arm infrastructure, delivery system, machine vision, and integrated communication. Also covers the storage systems for production, integration uncertainties, failure modes, facts, and troubleshooting topics.

**IE 5390. Structured Data Analytics for Industrial Engineering. (4 Hours)**

Covers fundamental knowledge and skills for using structured data analytics for IE applications. Offers students an opportunity to learn data cleaning and preparation, as well as analytics of data sets, and coding in VBA (writing macros and creating GUI), both as a driver of spreadsheet formulas and as a stand-alone programming language. A final project involves the development and presentation of a structured data analytics application that addresses industrial engineering concepts.

**Prerequisite(s):** (IE 4515 with a minimum grade of D- or OR 6205 with a minimum grade of C-); (IE 3412 with a minimum grade of D- or IE 6200 with a minimum grade of C- )

**IE 5400. Healthcare Systems Modeling and Analysis. (4 Hours)**

Discusses the key functions of healthcare operations management, such as patient and process flow, process improvement, facility layout, staffing and scheduling, capacity planning, and resource allocation. Focuses on analysis, design, management, and control of health systems and processes that are necessary to provide clinical care. The applications of systems engineering methods, such as optimization, simulation, and queuing models, are discussed through papers and case studies in different care settings (e.g., hospitals, emergency departments, surgery departments, and outpatient clinics) for different diseases (e.g. diabetes, cancer, mental health, cardiovascular disease). Uses spreadsheet tools to model and solve simulation and optimization problems. Requires equivalent course work if prerequisites are not met.

**Prerequisite(s):** IE 4515 with a minimum grade of D- or OR 6205 with a minimum grade of C-

**IE 5500. Systems Engineering in Public Programs. (4 Hours)**

Introduces the design, development, analysis, and application of mathematical modeling for addressing public programs and societal needs. Systems engineering and mathematical models form the basis for decision making in both public and private applications. Focusing on societal applications, offers students an opportunity to discover how to incorporate public objectives and characteristics of large systems in the development of models and policies. Examines applications in the operation of public programs (e.g., public health systems, government programs) and public safety (e.g., security, emergency preparedness, and disaster response). Modeling techniques include game theory, data envelopment analysis, cost-benefit analysis, simulation, differential equations, and stochastic optimization. Requires equivalent course work if prerequisites are not met.

**Prerequisite(s):** (IE 4515 with a minimum grade of D- or OR 6205 with a minimum grade of C-); (IE 3412 with a minimum grade of D- or IE 5374 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or IE 5374 with a minimum grade of C- (Graduate) or IE 6200 with a minimum grade of C- or IE 6400 with a minimum grade of C- )

**IE 5617. Lean Concepts and Applications. (4 Hours)**

Covers the fundamentals of lean thinking and how to apply this knowledge to practical problems. Lean thinking is imperative for organizations aspiring to stay competitive in global markets. It calls for process changes to eliminate waste, shorten product delivery time, improve product quality, and curtail costs, while improving customer satisfaction. Offers students an opportunity to learn concepts, a kit of process improvement tools, implementation methods, and best practices for lean workforce development. Makes extensive use of active learning exercises and simulations, and case studies from different disciplines, to help students learn how lean principles are applied in manufacturing and also in less traditional areas such as knowledge work and healthcare systems.

**Corequisite(s): IE 5618**

**IE 5618. Recitation for IE 5617. (0 Hours)**

Accompanies IE 5617. Provides small group demonstrations, exercises, and team activities.

**Corequisite(s): IE 5617**

**IE 5630. Biosensor and Human Behavior Measurement. (4 Hours)**

Emphasizes the measurement of human behavior in complex human-machine interaction. Topics include introduction of complex human-machine interactions; research methods in complex human-machine interactions; various kinds of human psychophysiological signals/cues, including physiological cues, facial expressions, eye-gaze movement, head movement, contextual cues; human cues and behavior relationship; transducers and measurement for these human cues/signals; basic principles of biosensors; general classification of biosensors; current technologies for building biosensors; conventional transducers and new technologies including micro-/nanotechnology; general systematic design process for biosensors; application of biosensors to understand human behavior in human-machine interactions. Also introduces the latest relevant research advancements in sensor fusion, affective computing, and emotion recognition.

**IE 5640. Data Mining for Engineering Applications. (4 Hours)**

Introduces data mining concepts and statistics/machine learning techniques for analyzing and discovering knowledge from large data sets that occur in engineering domains such as manufacturing, healthcare, sustainability, and energy. Topics include data reduction, data exploration, data visualization, concept description, mining association rules, classification, prediction, and clustering. Discusses data mining case studies that are drawn from manufacturing, retail, healthcare, biomedical, telecommunication, and other sectors.

**IE 5976. Directed Study. (1-4 Hours)**

Offers theoretical or experimental work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated up to a maximum of 12 total semester hours.

**IE 6200. Engineering Probability and Statistics. (4 Hours)**

Studies fundamental concepts of probability. Topics include events, sample space, and discrete and continuous random variables; density functions, mass functions, cumulative probability distributions, and moment generating functions; expectation of random variables; common discrete and continuous probability distributions including binomial, Poisson, geometric, uniform, exponential, and normal; multivariate probability distributions, covariance, and independence of random variables; sampling and descriptive statistics; and parameter estimation, confidence intervals, and hypothesis testing. Also introduces analysis of variance. Requires knowledge of multivariate calculus.

**IE 6300. Manufacturing Systems Design. (4 Hours)**

Provides a comprehensive exploration of advanced topics in modern manufacturing. Delves into the principles, theories, and practices that underpin manufacturing systems in diverse industries. Covers a range of essential subjects, including manufacturing processes and operations, manufacturing economics, factory dynamics, lean manufacturing principles, production planning and control, assembly lines, system configurations, quality management, Industrial Internet of Things (IIoT) and Industry 4.0, and real-world case studies.

**IE 6400. Foundations for Data Analytics Engineering. (4 Hours)**

Offers topics and skills designed to prepare students for advanced courses in data analytics engineering. Covers basic concepts and implementation of methods related to probability, eigenvalues and eigenvectors, cluster analysis, text mining, and time series analysis. Offers students an opportunity to learn how to work with modern data structures and apply computational methods for data cleaning and data wrangling operations.

**IE 6500. Human Performance. (4 Hours)**

Explores a wide range of human-machine systems. Focuses on human performance, human system integration, evaluation, and applications and how they can improve productivity, efficiency, safety, and quality of work life. Involves designing of machines, operations, jobs, and work environments in systems so that they are compatible with human capabilities, characteristics, and limitations. Discusses a variety of human-machine systems and interactions, including transportation, healthcare, human-computer, human-robot, consumer products, and service industries.

**IE 6600. Computation and Visualization for Analytics. (4 Hours)**

Offers students an opportunity to learn how to use visualization tools and techniques for data exploration, knowledge discovery, data storytelling, and decision making in engineering, healthcare operations, manufacturing, and related applications. Covers basics of Python and R for data mining and visualization. Introduces students to static and interactive visualization charts and techniques that reveal information, patterns, interactions, and comparisons by focusing on details such as color encoding, shape selection, spatial layout, and annotation.

**IE 6700. Data Management for Analytics. (4 Hours)**

Covers the theory and applications of database management to support data analytics, data mining, machine learning, and artificial intelligence. Discusses the fundamental concepts and emerging technologies in database design and modeling, database systems, data storage, and the evolving world of data warehousing and data governance. Presents a balanced theory-practice focus and covers relational databases, NoSQL databases, data integration, data quality, data governance, big data, and data processing for analytics.

**IE 6750. Data Warehousing and Integration. (4 Hours)**

Covers various topics in data engineering in support of decision support systems, data analytics, data mining, machine learning, and artificial intelligence. Studies on-premises data warehouse architecture, dimensional modeling of data warehouses, extract-transform-load integration from source systems to data warehouse, online analytical processing systems, and the evolving world of data quality and data governance. Offers students an opportunity to design, develop, and maintain cloud-based data pipelines. Uses both on-premises and cloud-based platforms to illustrate and implement data engineering techniques using operational and analytical data warehouses.

**Prerequisite(s):** IE 6700 with a minimum grade of C-

**IE 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**IE 7200. Supply Chain Engineering. (4 Hours)**

Presents modern quantitative techniques for designing, analyzing, managing, and improving supply chains using deterministic and probabilistic models. Topics include a macro view of supply chains, demand forecasting, aggregate planning, sequencing and scheduling, inventory analysis and control, materials requirement planning, pricing and revenue management, contracts decisions, transportation decisions, location and distribution decisions, supplier selection methods, and global supply chains.

**Prerequisite(s):** (IE 5374 with a minimum grade of D- or IE 5374 with a minimum grade of C- (Graduate) or IE 6200 with a minimum grade of C- or MATH 7241 with a minimum grade of C or IE 6400 with a minimum grade of C- ); OR 6205 with a minimum grade of C-

**IE 7215. Simulation Analysis. (4 Hours)**

Covers elementary queueing models, simulation and modeling, simulation model design, a survey of simulation languages with one language covered in detail, input data analysis and distribution fitting, model verification and validation, output analysis and transient/steady-state response, terminating/nonterminating systems, model experimentation and optimization, random number/random variate generation, and variance reduction techniques.

**Prerequisite(s):** IE 5374 with a minimum grade of D or IE 5374 with a minimum grade of C (Graduate) or IE 6200 with a minimum grade of C or IE 6400 with a minimum grade of C- or MATH 7241 with a minimum grade of C

**IE 7270. Intelligent Manufacturing. (4 Hours)**

Covers advanced and emerging topics in manufacturing. Discusses fundamentals of digital and cyber-physical manufacturing including machine communication protocols, control architectures, agent-based and holonic systems, cloud-based and service-oriented manufacturing, and applications of artificial intelligence in manufacturing.

**IE 7275. Data Mining in Engineering. (4 Hours)**

Covers the theory and applications of data mining in engineering. Reviews fundamentals and key concepts of data mining, discusses important data mining techniques, and presents algorithms for implementing these techniques. Specifically covers data mining techniques for data preprocessing, association rule extraction, classification, prediction, clustering, and complex data exploration. Discusses data mining applications in several areas, including manufacturing, healthcare, medicine, business, and other service sectors.

**Prerequisite(s):** CS 5800 with a minimum grade of C or EECE 7205 with a minimum grade of C or IE 5374 with a minimum grade of C or IE 5374 with a minimum grade of D or IE 6200 with a minimum grade of C or IE 6400 with a minimum grade of C or MATH 7241 with a minimum grade of C

**IE 7280. Statistical Methods in Engineering. (4 Hours)**

Discusses statistical models for analysis and prediction of random phenomena. Topics include review of descriptive statistics and hypothesis testing, linear models, both regression and ANOVA. Introduces design of experiments. Covers experiments with single and multiple factors of interest, and considers experiments with high-order experimental restrictions.

**Prerequisite(s):** IE 5374 with a minimum grade of D or IE 5374 with a minimum grade of C (Graduate) or IE 6200 with a minimum grade of C or IE 6400 with a minimum grade of C or MATH 7241 with a minimum grade of C

**IE 7285. Statistical Quality Control. (4 Hours)**

Designed to study the fundamental concepts of quality planning and improvements. Studies analysis and application of modern statistical process control methods including cusum, EWMA, multivariate, and modified control charts. Covers inspection error and design of sampling plans. Topics include software quality assurance, and study of the concepts of Deming, Ishikawa, Feigenbaum, and Taguchi's approach in quality planning, organization, and improvement.

**Prerequisite(s):** IE 6200 with a minimum grade of C or IE 6400 with a minimum grade of C or MATH 7241 with a minimum grade of C

**IE 7290. Reliability Analysis and Risk Assessment. (4 Hours)**

Studies principles of the methods of risk assessment and reliability analysis including fault trees, decision trees, and reliability block diagrams. Discusses classical, Bayesian, and median rank methods for analysis of components and systems reliability. Presents various factors that determine the stress and strength of components and their impact on system reliability. Uses practical applications, examples, and problems to cover a broad range of engineering fields, such as mechanical, electrical, industrial, computer, structures, and automatic control systems.

**Prerequisite(s):** IE 6200 with a minimum grade of C or IE 6400 with a minimum grade of C- or MATH 7241 with a minimum grade of C

**IE 7295. Applied Reinforcement Learning in Engineering. (4 Hours)**

Covers fundamentals of reinforcement learning (RL) and its applications in engineering areas. Provides an overview of the RL concepts and important algorithms. Demonstrates applications of RL to address engineering problems in manufacturing, supply chain, healthcare, and engineering economics. Offers students an opportunity to master their skills to apply RL to practical engineering projects through a series of lab sessions.

**Prerequisite(s):** IE 5374 with a minimum grade of C or IE 5374 with a minimum grade of D or IE 6200 with a minimum grade of C or IE 6400 with a minimum grade of C or MATH 7241 with a minimum grade of C

**IE 7300. Statistical Learning for Engineering. (4 Hours)**

Covers statistical models and methods for data analytics. Reviews fundamentals and key concepts in statistical inferences and learning theory. Presents important statistical learning techniques and algorithms for implementation. Discusses ordinary least square for regression, overfitting and regularization, generalized linear models, and nonlinear and nonparametric models. Applies Bayesian statistics for classification problems. Offers theoretical aspects including the statistical learning framework, conditional probabilistic methods, and their applications in several areas including manufacturing, healthcare, and business.

**Prerequisite(s):** IE 5200 with a minimum grade of C- or IE 5374 with a minimum grade of D or IE 5374 with a minimum grade of C (Graduate) or IE 6200 with a minimum grade of C or IE 6400 with a minimum grade of C- or IE 6800 with a minimum grade of C- or MATH 7241 with a minimum grade of C

**IE 7315. Human Factors Engineering. (4 Hours)**

Offers students an opportunity to acquire the necessary knowledge and skills to recognize and analyze existing or potential human factors problems and to identify, design, and possibly implement feasible solutions. Includes introduction to human factors and ergonomics; engineering anthropometry and biomechanics; physiology related to human factors and workstation design; cognition and information processing; decision making, attention, and workload; human error and accidents; human-machine interface design; controls and displays; and human factors applications in transportation, aerospace, consumer product design, and so forth.

**IE 7350. Sociotechnical Systems: Computational Models for Design and Policy. (4 Hours)**

Presents state-of-the-art computational methods and case studies for modeling and designing sociotechnical systems. Focuses on the dynamic interactions between the social and technical aspects and incorporating computational models of human behavior into design, governance, and policy decisions. Begins with general model thinking methods and discusses the modeling of individual decision making and bounded rationality. Delves into the dynamics of group interaction and strategic multiagent decisions and the emergence of group behavior, particularly in network structures. Includes modeling dynamics of human-AI systems in multiagent setups and empirical analysis of governance mechanisms in sociotechnical systems.

**Prerequisite(s):** IE 6200 with a minimum grade of C- or IE 6400 with a minimum grade of C- or MATH 7241 with a minimum grade of C- or NETS 7334 with a minimum grade of C-

**IE 7374. Special Topics in Industrial Engineering. (4 Hours)**

Offers topics of interest to the staff member conducting this class for advanced study. May be repeated without limit.

**IE 7440. Industrial Engineering Leadership Challenge Project 1. (4 Hours)**

Offers students an opportunity to develop and present a plan for the demonstration of a marketable technology product or prototype with an industrial-engineering focus. Constitutes the first half of a thesis-scale project in technology commercialization. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological and engineering depth and fostering the student's leadership development.

**IE 7442. Industrial Engineering Leadership Challenge Project 2. (4 Hours)**

Continues IE 7440, further developing a thesis-scale project in technology commercialization. Offers students an opportunity to demonstrate their development of a marketable technology product or prototype with an industrial engineering focus and produce a written documentary report on the project to the satisfaction of an advising committee. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological and engineering depth and fostering the student's leadership development.

**Prerequisite(s):** IE 7440 with a minimum grade of C-

**IE 7500. Applied Natural Language Processing in Engineering. (4 Hours)**

Covers fundamentals of natural language processing and its applications in engineering areas. Presents an overview of the NLP concepts and important algorithms. Demonstrates applications of NLP to address engineering problems in transportation, civil engineering, manufacturing, healthcare, business, commerce, and selected other areas of engineering. A substantial course project offers students an opportunity to solidify their skills to apply NLP to practical engineering problems.

**Prerequisite(s):** IE 5374 with a minimum grade of C or IE 5374 with a minimum grade of D or IE 6200 with a minimum grade of C or IE 6400 with a minimum grade of C or MATH 7241 with a minimum grade of C

**IE 7615. Neural Networks and Deep Learning. (4 Hours)**

Covers the theory and applications of neural networks in engineering. Reviews basics of machine learning, discusses important neural network architectures, and presents neural network training methods and algorithms. The specific neural network models covered in this course include feedforward neural networks such as deep learning architectures, radial basis function networks, support vector machines, self-organizing feature maps, and recurrent networks. Discusses neural network applications in several areas including manufacturing, healthcare, medicine, business, and diagnostics and prognostics.

**Prerequisite(s):** (IE 6400 with a minimum grade of C or IE 6600 with a minimum grade of C); IE 7275 with a minimum grade of C

**IE 7945. Master's Project. (4 Hours)**

Offers theoretical or experimental work under individual faculty supervision.

**IE 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**IE 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated eight times for a maximum of 8 semester hours.

**IE 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**IE 7990. Thesis. (4 Hours)**

Offers analytical and/or experimental work conducted under the direction of the faculty in fulfillment of the requirements for the degree.

**Prerequisite(s):** IE 7945 with a minimum grade of C-

**IE 7996. Thesis Continuation - Half-Time. (0 Hours)**

Continues thesis work conducted under the supervision of a departmental faculty member.

**IE 8960. Candidacy Preparation—Doctoral. (0 Hours)**

Offers students an opportunity to prepare for the PhD qualifying exam under faculty supervision. Intended for students who have completed all required PhD course work and have not yet achieved PhD candidacy; students who have not completed all required PhD course work are not allowed to register for this course. May be repeated once.

**IE 8986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**IE 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of program requirements for PhD candidacy.

**IE 9986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**IE 9990. Dissertation Term 1. (0 Hours)**

Offers dissertation supervision under individual faculty supervision.

**Prerequisite(s):** IE 9000 with a minimum grade of S

**IE 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** IE 9990 with a minimum grade of S

**IE 9996. Dissertation Continuation. (0 Hours)**

Offers continuing dissertation supervision under individual faculty supervision.

**Prerequisite(s):** IE 9991 with a minimum grade of S or Dissertation Check with a score of REQ

**Information Science (IS)**

**IS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**IS 2050. Information and Uncertainty. (4 Hours)**

Introduces the foundations of probabilistic inference, information theory, and their uses for drawing conclusions from noisy data. Applications include diagnosing diseases with inconclusive medical tests, locating autonomous vehicles when sensors are imperfect, and how best to make inferences with incomplete or partial information. Central topics include distinguishing deductive and probabilistic inference, philosophical interpretations of probability, fundamental justifications for the rules of probability, and key concepts of information theory. Introduces analytic and mathematical methods of analysis in these cases and contemporary computational (i.e., programming) techniques for implementing and applying theories of information and probabilistic inference.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**IS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**IS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**IS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**IS 4991. Research. (4,8 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated up to three times.

**Prerequisite(s):** IS 4800 with a minimum grade of D- or (CS 5350 with a minimum grade of C- or CS 5350 with a minimum grade of D- )

**Attribute(s):** NUpath Capstone Experience, NUpath Integration Experience, NUpath Writing Intensive

## Information Systems Program (INFO)

**INFO 5001. Application Modeling and Design. (4 Hours)**

Practices social-technical software engineering methods and tools to solve real-world problems. Explores innovative design and programming techniques to build significant business applications quickly. Studies the process of systematically combining UX techniques, business processes, and complex data models to assemble applications that are user-friendly and meet business requirements. Employs the object-oriented paradigm, visual user interface design principles, and programming languages such as Java, as well as productivity tools, to put together complicated, powerful business applications with ease. Explores the art of how to systematically write software programs to solve any business problem, through practicing simple and smart ways of making software programming enjoyable.

**INFO 5002. Introduction to Python for Information Systems. (4 Hours)**

Studies the Python programming language for application engineering. This hands-on course offers students an opportunity to obtain proficiency in the core concepts of Python and the skills and knowledge for building applications using any of the hundreds of thousands of task-specific Python libraries. Covers the important concepts such as reading and writing to standard IO, using operators, controlling the flow of execution, using functions, reading and writing files, and basic object-oriented programming concepts. Applies tools and techniques to classical software engineering and Python-specific facilities such as code introspection, reuse, built-in sequence types, and iteration.

**INFO 5100. Application Engineering and Development. (4 Hours)**

Takes students in a step-by-step manner through the process of systematically combining UX techniques, business processes, and complex data models to assemble applications that are user-friendly and meet business requirements. Employs the object-oriented paradigm, visual user experience, and system design principles to put together complicated, powerful, real-world applications. The primary objective of this course is to practice social-technical software engineering methods and tools to solve real-world problems. Offers students an opportunity to learn innovative design and programming techniques to build significant business applications quickly; to practice simple and smart ways of making software construction enjoyable; and to master the art of how to systematically write software programs to solve any business problem.

**Corequisite(s):** INFO 5101

**INFO 5101. Lab for INFO 5100. (0 Hours)**

Accompanies INFO 5100. Provides additional instruction in Java programming.

**Corequisite(s):** INFO 5100

**INFO 5260. Introduction to Business Process Engineering. (4 Hours)**

Examines modern trends and innovative techniques for improving organizational productivity, operational efficiency, and project performance through process engineering. Analyzes the origins and evolution of business processes, their impact on strategic objectives, and methods for identifying inefficiencies and opportunities for improvement. Covers frameworks for diagnosing process issues, redesigning workflows, and implementing reengineered solutions. Emphasizes strategies for communicating process changes effectively to technical and nontechnical stakeholders and securing organizational support.

**INFO 5374. Special Topics in Information Systems. (1-4 Hours)**

Offers topics of current interest in information systems. May be repeated up to three times for a maximum of 16 semester hours.

**INFO 5976. Directed Study. (1-4 Hours)**

Offers theoretical or experimental work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated seven times for up to 8 semester hours.

**INFO 6105. Data Science Engineering Methods and Tools. (4 Hours)**

Introduces the fundamental techniques for machine learning and data science engineering. Discusses a variety of machine learning algorithms, along with examples of their implementation, evaluation, and best practices. Lays the foundation of how learning models are derived from complex data pipelines, both algorithmically and practically. Topics include supervised learning (parametric/nonparametric algorithms, support vector machines, kernels, neural networks, deep learning) and unsupervised learning (clustering, dimensionality reduction, recommender systems). Based on numerous real-world case studies.

**Prerequisite(s):** INFO 5100 (may be taken concurrently) with a minimum grade of B- or INFO 5100 (may be taken concurrently) with a minimum grade of B- or CSYE 6200 (may be taken concurrently) with a minimum grade of B-

**INFO 6106. Neural Modeling Methods and Tools. (4 Hours)**

Uses a graph theoretic approach to build models representing dependencies of model components instead of using analytical functions in statistics to interpolate observations, build data models, and estimate model parameters. The interpolation is still parametric, but the parameters are graph related and do not involve analytic functions. Discusses how to explain neural models and not fear them; when it is appropriate to use neural models; and how to interact with machines that use neural models in the same way one would trust a friend, so that trust between humans and machines is enhanced rather than diminished. These so-called neural models mirror in some regard how biological brains build models to make sense of the world and do predictions.

**Prerequisite(s):** INFO 6105 with a minimum grade of B

**INFO 6150. Web Design and User Experience Engineering. (4 Hours)**

Focuses on advanced user interface engineering, with a strong emphasis on utility and personalized user experiences development. Through the use of tools like React and Flutter, explores how to engineer highly personalized web applications tailored to individual user needs and preferences. Topics include responsive layouts, interactive elements, animation integration, and performance tuning. Offers students an opportunity to gain hands-on experience in building interfaces that dynamically adapt to user behavior, preferences, and context, ensuring a unique and engaging experience for each user.

**Prerequisite(s):** INFO 5100 (may be taken concurrently) with a minimum grade of B- or INFO 5100 (may be taken concurrently) with a minimum grade of B- or CSYE 6200 (may be taken concurrently) with a minimum grade of B-

**INFO 6205. Program Structure and Algorithms. (4 Hours)**

Presents data structures and related algorithms, beginning with a brief review of dynamic memory allocation. Discusses the fundamental data structures in detail, including the abstract representation, supporting algorithms, and implementation methods. Focuses on understanding the application of the abstract data structure and the circumstances that affect implementation decisions. Covers lists, stacks, queues, trees, hash tables, and graphs. Covers recursion and searching and sorting algorithms in detail. Emphasizes data abstraction and encapsulation in code design. Explores external storage structures, time permitting.

**Prerequisite(s):** INFO 5100 with a minimum grade of B- or INFO 5100 with a minimum grade of B- or CSYE 6200 with a minimum grade of B-

**INFO 6215. Business Analysis and Information Engineering. (4 Hours)**

Covers computer information systems and the decision-making process, determination of information requirements, system development life cycle, and system modeling and analysis. Uses a hands-on approach to introduce the student to software engineering methodologies and practices, business requirements specification, business process design, model-driven object-oriented design, software development, and maintenance. Emphasizes the effective leverage of the Unified Modeling Language (UML) to transform business issues and objectives to concrete software solutions that meet business needs and usability and user interface design as critical elements of a successful software engineering engagement.

**INFO 6245. Planning and Managing Information Systems Development. (4 Hours)**

Provides an overview of the most popular information systems needs' assessment methodologies including portfolio analysis, stage assessment, business systems planning, and the Alloway survey technique. Topics include utilities IS strategic plan prioritization techniques of business goal alignment, architectural compatibility, and cost/benefit and risk analysis to demonstrate how businesses match needs to budgetary constraints. Describes and evaluates options for the placement of the IS function within the organization and a variety of methods to manage the function. Introduces a generic application development and project planning methodology used as a model to facilitate the development of a four-stage project plan for a prototype project. Uses the Project Management Institute's PMBOK and Harvard Business School case studies extensively.

**INFO 6250. Web Development Tools and Methods. (4 Hours)**

Explores advanced server-side technologies and tools necessary to design and engineer complete web-based enterprise applications quickly. Designed to build on previous experience to cover the life cycle of a web-based application. Focuses on MVC web development frameworks to build server-side, data-intensive, and multitier web applications. Additionally, discusses designing rich internet applications (RIA) using AJAX and service-oriented architecture (SOA) using REST.

**Prerequisite(s):** INFO 5100 with a minimum grade of B- or INFO 5100 with a minimum grade of B-

**Corequisite(s):** INFO 6251

**INFO 6251. Lab for INFO 6250. (0 Hours)**

Accompanies INFO 6250. Offers additional instruction in Web tools discussed in class.

**Corequisite(s):** INFO 6250

**INFO 6255. Software Quality Control and Management. (4 Hours)**

Examines techniques for the management and evolution of software systems. Topics include managing software as an asset; life cycle development and rapid development technologies; maintainability; quality assurance of software systems including testing strategies and problem analysis; software risk analysis; analysis of software project failures; process models, such as CMM and ISO 9001; configuration management; and the impact of new development technologies on software management.

**Prerequisite(s):** INFO 5100 (may be taken concurrently) with a minimum grade of B- or CSYE 6200 (may be taken concurrently) with a minimum grade of B-

**INFO 6320. Large Language Models in Healthcare: Foundations and Applications. (4 Hours)**

Examines fundamentals and applications of large language models in healthcare. Covers core architectures such as recurrent neural networks and transformers, attention mechanisms, and self-supervised learning techniques. Investigates the role of LLMs in clinical applications including chatbots, question answering systems, sentiment analysis, and retrieval-augmented generation. Highlights the integration of LLMs with medical imaging, healthcare systems, and drug discovery workflows. Emphasizes practical methods for developing, fine-tuning, and evaluating LLM-based solutions using real-world healthcare datasets.

**INFO 6350. Smartphones-Based Web Development. (4 Hours)**

Covers application development for mobile devices using advanced development platforms. Focuses on how to write mobile applications using cross-platform development tools and processes. Topics include user interfaces, the software life cycle, persistent storage, networking using HTTP and other REST interfaces, and mobile/handheld data applications. Requires a final project.

**Prerequisite(s):** INFO 5100 with a minimum grade of B- or INFO 5100 with a minimum grade of B- or CSYE 6200 with a minimum grade of B-

**INFO 6374. Special Topics in Information Systems. (1-4 Hours)**

Offers topics of current interest in information systems. May be repeated up to three times for a maximum of 16 semester hours.

**INFO 6500. Managing Operational Risk for Engineering. (4 Hours)**

Presents an in-depth study of risk management in engineering and technical environments, focusing on identifying, assessing, and mitigating risks. Covers strategies for monitoring and response planning while examining the impact of organizational factors, such as communication and culture, on risk practices. Emphasizes real-world applications through case studies and emerging risk assessments. Explores approaches to implementing security controls, developing incident response plans, and ensuring compliance with industry standards.

**INFO 6660. Business Ethics and Intellectual Property for Engineers. (4 Hours)**

Seeks to support successful engineering careers by offering students an applied understanding of ethical principles in the workplace and fundamentals of intellectual property and the American legal system. Seeks to increase students' awareness of the ethical implications of their work and to influence colleagues to think and act in a socially cognizant manner. Introduces ethical principles and codes of professional ethics; types of intellectual property (patents, trade secrets, trademarks, copyrights); and fundamentals of the American legal system (sources of American law, contracts, torts, intellectual property, antitrust). Offers students an opportunity to practice verbal communication and presentation skills; develop an applied understanding of the relationship and differences between legal liability and ethical behavior; and develop applied critical thinking, communication, and presentation skills.

**INFO 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INFO 7110. High-Performance Coding for Fintech. (4 Hours)**

Distills the programming challenges constantly faced by quantitative developers in the fintech space. Presents high-performance computing challenges as well as their solutions for investment banks, market-making firms, capital management funds, and loan-financing institutions. Covers the art of high-performance computing using object-oriented structure of five prevailing programming languages widely adopted in the fintech industry: Java, C++, MATLAB, R, and Python. In particular, the course offers students an opportunity to obtain capabilities to successfully complete high-performance computing tasks in the following five application areas: global-macro arbitrage, quantitative equity portfolio management, option pricing and trading, fixed-income securities, and market making.

**Prerequisite(s):** INFO 6205 with a minimum grade of B-

**INFO 7205. Advanced Application Engineering Project. (4 Hours)**

Offers students an opportunity to master advanced software design and programming techniques for building complex software applications quickly. The engineering issues addressed assume the business problems are difficult to understand and manage in a practical manner—the system capacity must support thousands or even millions of users in a multitude of roles. Addresses high-performance computing requirements such as concurrency and control, scalability, replication, and failover.

**Prerequisite(s):** INFO 5100 with a minimum grade of C- or INFO 5100 with a minimum grade of D- or CSYE 6200 with a minimum grade of C-

**INFO 7225. Accounting and Budgetary Systems for Engineers. (4 Hours)**

Covers the latest engineering principles necessary for building complex software systems that comply with recognized standards in the financial industry. With automated business processes today, risk and responsibility are shifting to information technology (IT) systems. Offers students an opportunity to learn how to incorporate information-based controls related to the financial industry that signal trouble, detect violations, and provide accountability, as well as a working approval process. Emphasizes software design. Seeks to help engineers construct complex software from a sophisticated engineering perspective. Examines how to put together cutting-edge organizational systems that people in the financial world can put to good use. Designed to prepare students for jobs in the building, maintaining, and employment of such information systems.

**INFO 7245. Agile Software Development. (4 Hours)**

Offers students an opportunity to achieve a high level of practical understanding of software development life cycle (SDLC) with emphasis on agile and adaptive incremental methodologies. Examines techniques for the management and evolution of software systems, including project planning from requirements gathering, analysis, estimation, and releasing using a hands-on approach to implement agile methodologies. Also covers maintainability, including software risk analysis, project retrospectives, and process models such as capability maturity model, configuration management, and their practical implementation.

**Prerequisite(s):** INFO 5100 with a minimum grade of B- or INFO 5100 with a minimum grade of B- or CSYE 6200 with a minimum grade of B-

**INFO 7250. Engineering of Big-Data Systems. (4 Hours)**

Introduces a general framework for thinking about big data. Services such as Web analytics and intelligent e-commerce have promoted a rapid increase in the volume of data generated, analyzed, and archived. In order to solve the problems related to big data, a newer type of database product has emerged. Covers how to apply technologies like Hadoop, Accumulo, MongoDB, and various NoSQL databases to build simple, robust, and efficient systems to manage and analyze big data. Also describes an easy approach to big data systems that can be built and run by a small team of students. Guides students through the theory of big data systems, how to implement them in practice, and how to deploy and operate them once they are built.

**Prerequisite(s):** INFO 6205 with a minimum grade of B- or INFO 6250 with a minimum grade of B- or INFO 7390 with a minimum grade of B- or CSYE 6220 with a minimum grade of B-

**INFO 7255. Advanced Big-Data Applications and Indexing Techniques. (4 Hours)**

Studies advanced indexing techniques and algorithms for big-data platforms such as Hadoop and NoSQL databases. Covers big-data design and indexing patterns to organize, aggregate, manipulate, and analyze huge amounts of data beyond human scale. Offers students an opportunity to learn advanced techniques to improve the performance and robustness of the advanced big-data programming models. Additional areas of focus include scalable graph databases, advanced indexing, and full-text searching in graph databases.

**Prerequisite(s):** CSYE 6220 with a minimum grade of B- or INFO 6205 with a minimum grade of B- or INFO 6250 with a minimum grade of B-

**INFO 7260. Business Process Engineering. (4 Hours)**

Addresses the question of how to understand and specify the flow of work responsibility and movement of information throughout the enterprise. For businesses to maximize the benefits of technology, they must transform their ad-hoc and often poorly defined ways of doing things to formal business processes. Analyzes the specification and implementation of complex information systems that integrate well into core business operations. Offers students an opportunity to learn how to use agile process specification techniques, dynamic process execution, and real-time measurement and reporting to support continuous business improvement and change.

**INFO 7285. Organizational Change and IT. (4 Hours)**

Focuses on the change effort needed to integrate a project into the firm's organizational structure, culture, business, and process metrics. Geared for students undertaking enterprise resource planning systems, or those involved in small or large organizational reengineering projects designed to make IT a primary focus of the firm's business strategy. Topics include management theories and organizational design principles; strategy and critical success factor formulation; methods to reach information systems maturity; business process modeling techniques; quality, the mindset, and the problem-solving tools; human resource, cultural, and technical change enablers; how to plan a business reengineering project; and implementation of major organizational change.

**INFO 7330. Information Systems for Healthcare Services Delivery. (4 Hours)**

Addresses the important information systems questions facing the delivery and assessment of healthcare services from administrative, financial, and clinical perspectives. Includes the use of electronic medical records; health information exchanges; and performance evaluation of providers, patients, and payers. Introduces how healthcare is delivered. Focuses on various information management tools being implemented as well as those needed to move care delivery and quality forward.

**INFO 7374. Special Topics in Information Systems. (1-4 Hours)**

Covers state-of-the-art material of current interest. May be repeated without limit.

**INFO 7375. Special Topics in Artificial Intelligence Engineering and Applications. (1-4 Hours)**

Covers recent advances in neural nets and deep learning techniques with applications to large-scale engineering problems. May be repeated up to five times for a maximum of 24 semester hours.

**INFO 7380. User Experience Design for Healthcare Applications. (4 Hours)**

Introduces the unique challenges of user experience research, design, and evaluation in a complex safety-critical domain with a systems engineering perspective. Covers regulations, standards, development processes, implementation, and adoption considerations for health technology. Designed to prepare students for the challenges UX professionals need to tackle when working on healthcare applications. Offers students an opportunity to build the necessary skill sets to enter the competitive and highly specialized industry of healthcare IT.

**Prerequisite(s):** CSYE 7280 with a minimum grade of B- or INFO 6150 with a minimum grade of B-

**INFO 7385. Managerial Communications for Engineers. (4 Hours)**

Focuses on communication strategies and tactics for engineers at the interpersonal, team, and organizational level. Course topics include forms (oral and written), styles, and differences in communication; coaching and giving feedback to staff; and building teams, managing conflict, and special topics in organizational communication. The primary goal is to strengthen the students' social and emotional intelligence skills to help them progress along their engineering career path. Combines academic content with practical skill-building activities.

**INFO 7390. Advances in Data Sciences and Architecture. (4 Hours)**

Covers a wide range of skills and responsibilities that are necessary for managing complex business performance and operational data. Such data tend to be fragmented, poorly organized, and often flawed. Offers students an opportunity to learn how a more up-to-date mapping of complex data works and to be alerted to the care and attention they must give to such a task as well as the implications of the results. Covers best practices for managing all aspects of the data transformation life cycle, covering broad areas such as requirements gathering, meta-model design, data integration and transformation, as well as implementation and ongoing operations. Discusses tools for mapping fragmented data into business intelligence solutions that guide successful strategies.

**Prerequisite(s):** INFO 6105 with a minimum grade of B

**INFO 7405. Advances in Engineering Medical Information Systems. (4 Hours)**

Focuses on the fundamentals of engineering patient medical records as timelines of medical encounters that capture critical clinical decisions made in various contexts such as assessments, diagnoses, treatments, etc. Record systems typically focus on data recording for legal purposes, ignoring the critical needs of patients and caregivers. Introduces innovative software design and architecture techniques that recognize the complex interaction between patients and caregivers, provide immediately available detailed information for both, and thus invigorate clinical workplaces. Emphasizes semantically rich clinical information models to support predictive analysis in order to recognize patterns of disease early. Covers techniques for engineering medical applications as sociotechnical systems that promote the safety, effectiveness, and efficiency of core clinical operations.

**Prerequisite(s):** INFO 5100 (may be taken concurrently) with a minimum grade of B- or INFO 5100 (may be taken concurrently) with a minimum grade of B-

**INFO 7410. Advanced Medical Device Software Engineering. (4 Hours)**

Offers students an opportunity to achieve an advanced level of practical knowledge and understanding of the medical device software development process and the skills needed to develop software for medical devices according to the FDA and IEC 62304 standards. Aiming to bridge the gap between theory and practice, this comprehensive and hands-on course combines lectures, case studies, and a capstone project to help students gain the necessary expertise to develop safe and effective medical device software.

**Prerequisite(s):** CSYE 6200 with a minimum grade of B- or INFO 5100 with a minimum grade of B-

**INFO 7500. Cryptocurrency and Smart Contract Engineering. (4 Hours)**

Seeks to provide a detailed understanding of the function and deployment of smart contracts using the Solidity language. Digs deep into the technical design and operation of blockchain platforms and specifically the implementation of smart contracts for operationalizing business processes. Offers students an opportunity to practice the development of decentralized autonomous organization applications using blockchain scripting languages.

**Prerequisite(s):** INFO 5100 with a minimum grade of B- or INFO 5100 with a minimum grade of B- or CSYE 6200 with a minimum grade of B-

**INFO 7510. Smart Contract Application Engineering and Development. (4 Hours)**

Emphasizes the essential coding skills for implementing self-enforcing, multiparty, mutually beneficial, contractual rights and obligations on top of blockchain technologies. Offers students an opportunity to learn how to leverage the principles and mechanisms of "decentralized autonomous organization" to programmatically coordinate the interaction between participating parties at a global scale without the need for trusting a third party and how to build blockchain-type applications that automate the interaction of a network of participating entities such as buyers, sellers, suppliers, insurance, and finance.

**Prerequisite(s):** INFO 7500 with a minimum grade of B-

**INFO 7520. Engineering of Advanced Cryptocurrency Systems. (4 Hours)**

Addresses programming and information systems aspects of bitcoin and other cryptocurrencies. Topics covered include fundamentals of bitcoin mining, the theory of distributed consensus, principles of strong anonymity and untraceability, smart contract security, and peer-to-peer networking. Offers students an opportunity to learn about current developments in, and challenges facing, the use of cryptocurrencies in terms of the computing platform and systems integration. Students also have an opportunity to gain practical experience through challenging programming projects.

**Prerequisite(s):** INFO 7500 with a minimum grade of B-

**INFO 7525. Regulatory Aspects of Smart Contract Automation. (2 Hours)**

Addresses the legal implication of using the blockchain to transfer and exchange money, perform trade transactions, maintain ownership of property, and enforce contractual obligations in secure and cost-effective ways. These applications present significant legal challenges in finance, property rights, and general commercial contracts in all industries. Offers students an opportunity to acquire the tools to engineer systems that adhere to existing and evolving regulatory frameworks. Highlights challenges around the issues of taxation, financial crimes, and money laundering, since blockchain technologies were designed to facilitate cross-border transactions.

**INFO 7535. Digital Smart Contracts Product Innovations. (2 Hours)**

Addresses the issue of how blockchain technology creates new ways of doing business. Blockchain technology uses bitcoin cryptocurrency to create value in a virtual setting. By linking the blockchain with real currency and the financial system, data, as well as business processes, a new breed of products and services can be realized. Explores innovative and disruptive applications of the blockchain.

**INFO 7610. Special Topics in Natural Language Engineering Methods and Tools. (4 Hours)**

Covers the latest techniques in natural language processing with applications to unstructured data.

**Prerequisite(s):** INFO 6205 with a minimum grade of B-

**INFO 7750. Engineering Advanced Healthcare Information Exchange Platforms. (4 Hours)**

Offers a deep dive into the realm of health information exchange systems, emphasizing their advantages, overcoming engineering challenges, and understanding the diverse HIE models. Addresses important safety concepts, eco-scale challenges, and systems and software engineering approaches to ensure robust, secure, and sustainable HIE implementations. Aims to develop a solid understanding of HIE's intricacies.

**Prerequisite(s):** CSYE 6200 with a minimum grade of B- or INFO 5100 with a minimum grade of B-

**INFO 7945. Master's Project. (4 Hours)**

Delves deeply into advanced concepts and methodologies within information systems. Emphasizes the development of critical thinking skills and the application of theoretical knowledge to practical challenges in the field. Through individual efforts, including laboratory work and/or literature review, students conduct a thorough investigation and analysis of various aspects of information systems. With guidance from their faculty advisor, students focus on a project tailored to their interests and goals. Students produce a detailed report outlining their findings, methodologies, and conclusions. Offers students an opportunity to present their work to peers and faculty, fostering scholarly discussion and collaboration.

**INFO 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INFO 7976. Directed Study. (1-4 Hours)**

Offers theoretical or experimental work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated seven times for up to 8 semester hours.

**INFO 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**INFO 7990. Thesis. (4 Hours)**

Offers theoretical and experimental work conducted under the supervision of a departmental faculty.

**Prerequisite(s):** INFO 7945 with a minimum grade of C-

**INFO 7996. Thesis Continuation - Half-Time. (0 Hours)**

Continues theoretical and experimental work conducted under departmental faculty supervision.

**Prerequisite(s):** INFO 7990 with a minimum grade of C-

## Information Technology - CPS (ITC)

**ITC 1000. Computer Applications. (3 Hours)**

Offers a beginning course in computer productivity tools for those with little or no prior experience. Introduces basic elements of organizing computer files and folders and of creating word processing documents, spreadsheets, and presentations. Requires a Windows environment.

**ITC 1200. Operating Systems Concepts. (3 Hours)**

Introduces students to the basic structure and organization of computer operating systems. Examines the functional characteristics of major computer components and their relationship to control by software. Topics include general computer organization and configuration. Compares characteristics of different operating systems such as Windows and UNIX.

**ITC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ITC 2000. Principles of Systems Analysis and Design. (3 Hours)**

Introduces the methodologies, models, tools, and techniques used in modern system development. Topics covered include project life-cycle models, project management techniques, requirements elicitation, use-case analysis, business rules, system design approaches, and graphic modeling with the Unified Modeling Language (UML). Offers students an opportunity to analyze and document a business case; complete a system analysis; and design, model, and prepare a project plan.

**Attribute(s):** NUpath Natural/Designed World

**ITC 2016. End-User Data Analysis Tools. (3 Hours)**

Focuses on technical skills used for acquiring and analyzing data with advanced spreadsheet tools and with end-user database software. Students use advanced word processing techniques to present the results of data analysis. Expects students to already have basic skills in word processing and spreadsheet applications. Course uses Windows-based applications.

**Attribute(s):** NUpath Analyzing/Using Data

**ITC 2050. Designing the User Experience. (3 Hours)**

Studies user experience (UX) design theory and practice, focusing on its interdisciplinary nature. Describes the principles of UX and the practice of user interface design. Discusses the major human information processing subsystems (perception, memory, attention, and problem solving), and introduces usability metrics and evaluation methods.

**ITC 2100. Introduction to Programming (Java). (3 Hours)**

Offers a hands-on first programming course for those with no prior programming experience. Covers basic programming logic and syntax. Uses object-oriented programming concepts, including arrays, methods, classes, and instantiation. Offers students an opportunity to code stand-alone computer applications with graphical user interfaces (GUI) using modern interactive development tools.

**Prerequisite(s):** MTH 2100 with a minimum grade of D- or MTH 2105 with a minimum grade of D- or MTH 2110 with a minimum grade of D- or MTH 2400 with a minimum grade of D-

**ITC 2200. Networking Foundations. (3 Hours)**

Introduces principles of computer networks, network architectures, network topologies, network protocols, and layering concepts. Addresses both theoretical aspects, such as performance modeling and analysis, and practical considerations of implementing Internet protocols.

**Prerequisite(s):** ITC 1200 with a minimum grade of D- ; ITC 2000 with a minimum grade of D-

**ITC 2300. Database Management Systems. (3 Hours)**

Introduces Structured Query Language (SQL). Topics include designing normalized data tables for use in a relational database management system, creating entity-relationship models, database transaction processing, and security.

**Prerequisite(s):** ITC 2000 with a minimum grade of D-

**ITC 2400. Web and Mobile Development. (3 Hours)**

Studies modern markup languages and standards (HTML5 and CSS) for cross-platform webpages and applications. Through lectures, discussions, and hands-on projects, offers students an opportunity to learn common best practices in graphical interface design and usability for different target audiences. They then have an opportunity to apply these design skills by refining creative designs into websites through an iterative process of creating hand-drawn storyboards, then coding wireframes, adding basic web content, and finally making pages responsive so that they are suitable for a variety of mobile devices. Webpage artifacts include tables, images, links, and simple apps.

**Attribute(s):** NUpath Creative Express/Innov

**ITC 2430. E-Commerce Systems. (3 Hours)**

Introduces the theory and practice of doing business on the Internet. Begins with the infrastructure that makes e-commerce possible, including Internet protocols, Internet applications, and Internet languages. Examines e-commerce software, e-commerce security issues, and e-commerce payment systems. Topics in business strategies for e-commerce include purchasing, electronic data interchange, supply chain management, virtual communities, and Web portals. Offers students an opportunity to understand how tools and strategies may be applied to e-business models, including business-to-business (B2B) and business-to-consumer (B2C). Examines international, legal, and ethical issues as they relate to e-commerce.

**Prerequisite(s):** MGT 1100 with a minimum grade of D-

**ITC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ITC 3100. Advanced Applications Development (Android). (3 Hours)**

Focuses on developing complex end-user applications (for Android) that address a business problem or opportunity. Topics include utilizing database interfaces and managing user sessions.

**Prerequisite(s):** ITC 2100 with a minimum grade of D- or GET 2100 with a minimum grade of D- or CET 2200 with a minimum grade of D-

**ITC 3150. Database Websites. (3 Hours)**

Offers students an opportunity to integrate relational databases into webpages. Covers how to query, update, and manage databases. Emphasizes using basic programming techniques (loops, conditionals, built-in functions) to interact with existing relational databases. All software used in the course is open source and runs on a variety of platforms.

**Prerequisite(s):** ITC 2300 with a minimum grade of D- ; ITC 2400 with a minimum grade of D-

**ITC 3220. Mobile and Wireless Networking. (3 Hours)**

Covers technologies used for wireless and mobile business applications. Topics include wireless network protocols, cellular phone carriers, wireless platform operating systems, and wireless security issues.

**Prerequisite(s):** ITC 2200 with a minimum grade of D-

**ITC 3250. UNIX Systems Administration. (3 Hours)**

Covers the essential skills needed to manage the day-by-day operations of a UNIX computer system. Topics include techniques for adding new users and groups and management of the file system, focusing on access controls. Covers backup plans and techniques as well as job scheduling and basic networking in the UNIX environment. Offers students an opportunity to build shell scripting skills.

**Prerequisite(s):** ITC 1200 with a minimum grade of D-

**ITC 3300. Structured Query Language (SQL). (3 Hours)**

Covers concepts and techniques for manipulating relational databases. Offers students an opportunity to learn to code native SQL for creating and accessing data tables, indexing, arithmetic operations, loops, arrays, multiple table processing, I/P operations, data-type conversions, and views.

**Prerequisite(s):** ITC 2300 with a minimum grade of D-

**ITC 3310. Exploring NoSQL Databases. (3 Hours)**

Explores the capabilities and applications of NoSQL technology in today's fast-paced digital world. Covers essential topics such as database architecture, security, and data distribution techniques in a NoSQL context. Offers students an opportunity to obtain hands-on practice with the most common nonrelational databases used in contemporary applications development.

**Prerequisite(s):** ITC 2300 with a minimum grade of D-

**ITC 3320. Data Warehousing Technologies. (3 Hours)**

Offers students an opportunity to learn how organizations construct and maintain data warehouses built from operational databases. Topics include a comparison of data warehouse architectures, how to build a data warehouse, and how to structure databases for efficient data analysis.

**Prerequisite(s):** ITC 2300 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**ITC 3400. Web Design and Multimedia. (3 Hours)**

Covers the history of multimedia technology, focusing on the uses of multimedia in website development. Examines the technical and design aspects of basic components of multimedia: text, audio, graphics, video, sound, animation, and virtual reality. Emphasizes the use of multimedia in user interfaces. This is a hands-on course in which students practice techniques throughout the course.

**Prerequisite(s):** ITC 2400 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**ITC 3500. IT Project Management. (3 Hours)**

Covers the tools and techniques used to manage information technology (IT) projects. Topics include project planning, scheduling, and budgeting and project management tools (PERT/CPM/Gantt). Discusses all phases of IT projects from proposal evaluation through postimplementation reviews. Offers students an opportunity to plan and develop a project that provides a practical application of the topics covered in class.

**Prerequisite(s):** ITC 2100 with a minimum grade of D- ; ITC 2200 with a minimum grade of D- ; ITC 2300 with a minimum grade of D- ; ITC 2400 with a minimum grade of D-

**Attribute(s):** NUpath Writing Intensive

**ITC 3620. Legal and Ethical Issues in Cybersecurity. (3 Hours)**

Describes the legal and ethical issues associated with information security. Emphasizes national and international laws relating to information assurance and data use and emerging technologies for management of digital rights. Examines criminal activities such as computer fraud and abuse, desktop forgery, embezzlement, child pornography, computer trespass, and computer piracy.

**Attribute(s):** NUpath Ethical Reasoning

**ITC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ITC 4200. Network Security. (3 Hours)**

Explores the theory and practice of computer security, focusing on the security aspects of multiuser systems and the Internet. Topics include cryptography concepts, firewalls; viruses; two-tier authentication; Trojan horses; password security; biometrics; VPNs; Internet protocols such as SSL, IPsec, PGP, SNMP, SSH; and others.

**Prerequisite(s):** ITC 2200 with a minimum grade of D-

**ITC 4600. Information Security Management. (3 Hours)**

Covers management issues occurring within the field of information security. Topics include asset classification and control (protecting the most valuable information of the organization); personnel security (employee awareness); security as a part of everyday communications and operations; business continuity management; and compliance (legal, internal/external, audit, and other concerns).

**Prerequisite(s):** ITC 2200 with a minimum grade of D- ; ITC 2300 with a minimum grade of D-

**ITC 4610. Penetration Testing. (3 Hours)**

Examines processes used in penetration testing and ethical hacking. Focuses on identifying, assessing, remediating, and managing cybersecurity risks and vulnerabilities effectively. Key topics include an overview of the current cybersecurity landscape; information gathering techniques; identification of vulnerabilities across network, host, and application attack vectors; and exploitation methods used by penetration testers and attackers. Analyzes the legal and regulatory frameworks governing penetration testing, including the ethics and professional standards that govern the legitimate actions of penetration testers. Blends theoretical knowledge and practical application to offer students an opportunity to obtain essential skills needed to strengthen the security posture of computer networks in various organizational contexts.

**Prerequisite(s):** ITC 2200 with a minimum grade of D-

**ITC 4640. Foundations of Cloud Computing. (3 Hours)**

Introduces the concepts and foundation principles of cloud services as they relate to commercial cloud service provider offerings such as AWS (Amazon Web Services). Covers compute, storage, networking, and security, as well as a variety of tools to carry out infrastructure tasks. Offers content beneficial to system administrators, developers, project managers, or those seeking a basic understanding of cloud computing. Includes hands-on exercises in the cloud. Specific programming skills are not required for this course.

**Prerequisite(s):** ITC 1200 with a minimum grade of D-

**ITC 4660. Encryption Concepts. (3 Hours)**

Surveys the principles and the practices of encryption and cryptography and the core encryption algorithms used in digital communication. Discusses core information assurance building blocks—such as authentication, digital signatures, key management, and digital certificates—and applies these concepts to important security architectures, including the IP networks and the cellular system.

**ITC 4670. Software Vulnerabilities. (3 Hours)**

Seeks to help students to become aware of systems software security issues and to gain a basic understanding of software security measures. Discusses software in use today, their related vulnerabilities, and how they are exploited. Examines protection and detection techniques and the secure software development life cycle.

**ITC 4680. Forensics in Information Technology. (3 Hours)**

Explores the techniques used in computer forensic examinations. Examines computer hardware, physical and logical disk structure, and computer forensic techniques. Builds awareness of the tools and techniques to investigate, seize, and analyze computer-based evidence.

**ITC 4690. Software Engineering and Security. (3 Hours)**

Focuses on secure software engineering. Offers students an opportunity to practice the development of software that adheres to secure design principles and uses modern software engineering best practices throughout the Secure Systems Development Lifecycle.

**Prerequisite(s):** ALY 2100 with a minimum grade of D- or CET 2200 with a minimum grade of D- or ITC 2100 with a minimum grade of D- or ITC 3100 with a minimum grade of D- or ITC 3150 with a minimum grade of D-

**ITC 4850. Information Technology Project. (3 Hours)**

Offers students an opportunity to utilize skills from across the discipline to create a final IT project in a team environment. This is the capstone course for the program, designed as the culminating experience that engages students in the execution of a real-world project.

**Prerequisite(s):** ITC 3500 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**ITC 4955. Project. (1-4 Hours)**

Provides students with an opportunity to demonstrate the skills they have learned throughout the program by developing an end-to-end proposal and plan for an IT application and the infrastructure it relies on. The project requires a justification, a budget, an architecture document, a presentation, and a project plan. May be repeated without limit.

**ITC 4973. Topics in Emerging Information Technologies. (3 Hours)**

Focuses on new and emerging technologies as they relate to information technology and software development. Specific topics vary based on developments in the field and include a discussion of the ethical effects of these developments.

**Prerequisite(s):** ITC 2100 with a minimum grade of D-

**ITC 4983. Topics. (1-4 Hours)**

Covers special topics in information technology. May be repeated without limit.

**ITC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ITC 5000. Database Management Systems. (2.25 Hours)**

Covers the use and capabilities of modern database management systems with an emphasis on performance and reliability. After a brief review of conceptual data models and database design, the focus moves to the underlying technology—database engines, storage and indexing, memory use, the relational model, normalization/de-normalization, query processing, and SQL. Also discusses the need for and design of concurrency control, integrity, security, and recovery capabilities.

**ITC 5010. Information Technology Strategy and Governance. (2.25 Hours)**

Focuses on the strategic use of information technology (IT) from a business perspective at the enterprise level. Covers business fundamentals and a strategic framework for aligning organizational strategy, core competencies, and information systems. Covers strategic IT management, including IT policy and governance, accountability frameworks, financial analysis, risk management, and legal compliance issues.

**ITC 5020. Information Systems Design and Development. (2.25 Hours)**

Discusses the planning, analysis, design, and implementation of computer-based information systems, focusing on the methodologies and procedures used in organizational problem solving and systems development. Topics include the systems development life cycle; project management; requirements analysis and specification; feasibility and cost-benefit analysis; logical and physical design; prototyping; system validation, deployment, and postimplementation review. Additional topics may include platform and database selection and integration issues, CASE tools, end-user training, maintenance, and object-oriented analysis and design.

**ITC 5035. Information Technology Project Management. (2.25 Hours)**

Covers the tools and techniques used to manage information technology projects. Topics include project planning, scheduling, and budgeting; project management tools (i.e., PERT/CPM/GANTT); and human resources management. Discusses all phases of IT projects from proposal writing through postrelease maintenance issues. Offers students an opportunity to plan and develop a project that provides a practical application of the topics covered in class.

**ITC 5300. Foundations of Information Security. (2.25 Hours)**

Offers an overview of the threats to the security of information systems, the responsibilities and basic tools for information security, and the levels of training and expertise needed in organizations to reach and maintain a state of acceptable security. Topics include an introduction to confidentiality, integrity and availability, authentication, encryption and access controls, intrusion detection and response, social engineering, physical security, policy formation and enforcement, legal and social issues, and risk management.

**ITC 5305. IT Infrastructure (Systems, Networks, Telecom). (2.25 Hours)**

Introduces the elements of IT infrastructure—systems, networks, and telecommunications. Telecommunication fundamentals include data, voice, image, and video. Covers the concepts, models, architectures, protocols, standards, and security for the design, implementation, and management of digital networks. Discusses the essentials of local area networks (LANs), metropolitan area networks (MANs), and wide area networks (WANs).

**ITC 5315. Information Security Risk Management. (2.25 Hours)**

Focuses on applying risk management to information security. Covers the security risk management life cycle including risk profiling, threat modeling, risk assessment, risk mitigation, and risk monitoring. Explores security controls, risk analysis techniques, vulnerability management, security governance, and industry standards and frameworks. Offers students an opportunity to practice risk assessments, propose mitigation plans, and present their risk management approaches.

**ITC 5345. Systems and Network Administration. (2.25 Hours)**

Focuses on the skills, tools, and best practices required to provide and support computing infrastructure and services. Aims to prepare the student to be responsible, from an ethical and legal perspective, for the infrastructure and computing system administration in an organization. Offers students an opportunity to obtain advanced technology enterprise infrastructure skills to support data centers and administer websites, as well as to resolve incidents, conduct troubleshooting, practice system backup and disaster recovery skills, and address system security issues.

**ITC 5355. Web Application Design and Development. (2.25 Hours)**

Introduces the development of Web applications. Topics covered include Web servers, Web application servers, Web application development methods, client-side and server-side scripting, and Web application development techniques. Offers students an opportunity to learn to construct and maintain a well-designed Web site and use state-of-the-art Web application development tools and languages to develop Web applications. Other topics include Web application security, session management, design patterns, and reusable Web application components.

**ITC 5400. Foundations of Informatics. (2.25 Hours)**

Introduces the fundamental properties of information, technologies, and people within an increasingly complex infrastructure and social system. Offers students an opportunity to learn theoretical foundations and applications of informatics and to explore technical and social issues—including policy choices, ethical issues, and legal obligations—with IT applications and solutions in various specific settings, such as business, education, healthcare, and government. Offers students a broad perspective and understanding of informatics as both a scientific field as well as a highly applied discipline in specific contexts that may help direct them to future career concentrations.

**ITC 5420. Introduction to Cloud Computing Applications and Management. (2.25 Hours)**

Offers an overview of theoretical and practical aspects of distributed systems and cloud computing. Cloud computing and web services are creating a huge demand for IT professionals to manage large-scale infrastructure and vast networks. Examines frameworks, techniques, and existing IT solutions to manage internet services at different levels (infrastructure, platform, and software) and to support the key characteristics of cloud computing, including virtualization, requirement for high reliability and security, extendability, and versatility.

**ITC 5450. Advanced Cloud Computing Applications and Management. (2.25 Hours)**

Offers a comprehensive learning experience in advanced concepts within cloud computing. Cloud computing has become a disruptive technology that has dramatically transformed the IT industry by offering scalability and delivery options that had not existed previously. Offers students an opportunity to gain an in-depth knowledge of concepts, programming models, virtualization options, file systems, architectures, storage, and secure computation, as well as to learn contemporary industry trends and what the future holds in the advanced concepts of cloud computing.

**Prerequisite(s):** ITC 6420 with a minimum grade of C- or ITC 6420 with a minimum grade of C-

**ITC 5480. Amazon Web Service (AWS) Cloud Architecting. (3 Hours)**

Exposees students to advanced technical topics to assist in the development of expertise in AWS cloud computing. Offers students an opportunity to gain the skills needed to pursue certification as an AWS Certified Solutions Architect—Associate, one of the most valuable IT certificates. Includes reading materials provided by AWS Academy, guided instruction in the classroom, hands-on labs operated by AWS, project work, and free practice exam if students wish to pursue certification after completing the course. Successful students have the ability to demonstrate knowledge and skills of how to architect and deploy secure and robust applications on AWS technologies.

**ITC 5490. Ethical Hacking. (2.25 Hours)**

Exposees students to the different phases of hacking, specific skills for penetration/intrusion testing, and demonstrates hands-on techniques in ethical hacking. Offers students an opportunity to gain technical capabilities to secure information systems, conduct network scanning and enumeration, and learn social engineering skills and techniques to protect networks from hackers.

**ITC 5520. Cloud Security Planning and Design. (2.25 Hours)**

Presents a comprehensive overview of the principles and practices of cloud computing security. Topics include the fundamentals of cloud computing security; the latest threats and attack vectors targeting cloud-based systems; and best practices for securing cloud infrastructure, applications, and data. Covers technical tools to protect data, data privacy, information systems, and enterprise networks from external compromise. Explores the field of cybersecurity: the body of technologies, processes, and practices designed to protect networks, devices, programs, and data from attack, damage, or unauthorized access. Examines the components of a well-architected cybersecurity framework, identifies the tools required, and guides students to create plans that will protect the digital assets of the enterprise.

**ITC 6000. Database Management Systems. (3 Hours)**

Covers the use and capabilities of modern database management systems with an emphasis on performance and reliability. After a brief review of conceptual data models and database design, the focus moves to the underlying technology—database engines, storage and indexing, memory use, the relational model, normalization/de-normalization, query processing, and SQL. Also discusses the need for and design of concurrency control, integrity, security, and recovery capabilities.

**ITC 6010. Information Technology Strategy and Governance. (3 Hours)**

Focuses on the strategic use of information technology (IT) from a business perspective at the enterprise level. Covers business fundamentals and a strategic framework for aligning organizational strategy, core competencies, and information systems. Covers strategic IT management, including IT policy and governance, accountability frameworks, financial analysis, risk management, and legal compliance issues.

**ITC 6015. Enterprise Information Architecture. (3 Hours)**

Introduces the theory, framework/model, methodology, and tools that enhance business and organizations' ability to discover, access, and understand data and to integrate IT and information resources, with an ultimate goal to produce information needed to make critical decisions and support business functions. Data and information management is critical to modern businesses. Covers best practices using cases studies in a more practical, comprehensive approach to delivering the subject matter involving the application of tools.

**ITC 6020. Information Systems Design and Development. (3 Hours)**

Discusses the planning, analysis, design, and implementation of computer-based information systems, focusing on the methodologies and procedures used in organizational problem solving and systems development. Topics include the systems development life cycle; project management; requirements analysis and specification; feasibility and cost-benefit analysis; logical and physical design; prototyping; system validation, deployment, and postimplementation review. Additional topics may include platform and database selection and integration issues, CASE tools, end-user training, maintenance, and object-oriented analysis and design.

**ITC 6030. Computer Systems and Networks. (3 Hours)**

Introduces the basic concepts of computer systems and networks. Covers operating system services, file systems, resource management, synchronization, the concept of a process, and process cooperation and interference. Introduces networks, including network architectures, network protocols, and communication paradigms (point-to-point, multicast/broadcast, and connectionless vs. connection-oriented). Uses examples from real operating systems and networks (Unix, Linux, Windows, TCP/IP, and Ethernet) to reinforce the concepts.

**ITC 6035. Information Technology Project Management. (3 Hours)**

Covers the tools and techniques used to manage information technology (IT) projects. Topics include project planning, scheduling, and budgeting; project management tools (i.e., PERT/CPM/GANTT); and human resources management. Discusses all phases of IT projects from proposal writing through postrelease maintenance issues. Offers students an opportunity to plan and develop a project that provides a practical application of the topics covered in class.

**ITC 6040. Informatics Capstone. (3 Hours)**

Offers students an opportunity to produce a polished paper, presentation, or product that reflects their training and focus in the fields of information systems (IS) and information technology (IT). Emphasizes aspects of integrating IS systems, technical architectures, and enterprise functions. Also offers students an opportunity to incorporate issues involving research and development or business and market strategies. Strongly encourages students to create a portfolio piece that can be shown to potential employers or current supervisors.

**Prerequisite(s):** ITC 6000 with a minimum grade of C- ; ITC 6010 with a minimum grade of C- ; ITC 6020 with a minimum grade of C- ; ITC 6035 with a minimum grade of C- ; ITC 6400 with a minimum grade of C- ; INT 6940 with a minimum grade of C-

**ITC 6045. Information Technology Policy, Ethics, and Social Responsibility. (3 Hours)**

Explores the policy choices, ethical issues, and legal obligations faced by organizations in the information age. Topics include intellectual property, freedom of expression, privacy, national security, impact of information technology (IT) on the work and home lives of employees, and ethical codes of conduct for IT professionals. Intended to sensitize IT managers and professionals to the issues that arise when doing business in an interconnected world and to develop an understanding of how to ethically and legally operate and use modern computer systems and networks.

**ITC 6082. Network Protection. (3 Hours)**

Examines the technical methods used to ensure that information using wired and wireless media reaches only those for whom it was intended. Covers the technical tools to protect information from external compromise. Explores load balancing, wireless access, Web security issues, and network intrusion detection. Offers students an opportunity to develop a detailed understanding of authentication, firewall configuration, and rule sets and to learn to address and prevent security issues related to intranets, extranets, enterprise networks, and the Internet.

**ITC 6300. Foundations of Information Security. (3 Hours)**

Offers an overview of the threats to the security of information systems, the responsibilities and basic tools for information security, and the levels of training and expertise needed in organizations to reach and maintain a state of acceptable security. Topics include an introduction to confidentiality, integrity and availability, authentication, encryption and access controls, intrusion detection and response, social engineering, physical security, policy formation and enforcement, legal and social issues, and risk management.

**ITC 6305. IT Infrastructure (Systems, Networks, Telecom). (3 Hours)**

Introduces the elements of IT infrastructure—systems, networks, and telecommunications. Telecommunication fundamentals include data, voice, image, and video. Covers the concepts, models, architectures, protocols, standards, and security for the design, implementation, and management of digital networks. Discusses the essentials of local area networks (LANs), metropolitan area networks (MANs), and wide area networks (WANs).

**ITC 6315. Information Security Risk Management. (3 Hours)**

Focuses on assessing, modeling, communicating, and addressing risk issues. Covers statistical, financial, technical, and other risk-assessment and risk-modeling techniques and tools. Explores policy and governance frameworks for information security risk management and the legal, behavioral, and social issues that arise in implementing security policies. Offers students an opportunity to develop risk assessments and present and justify mitigation proposals.

**ITC 6330. CISSP Preparation. (3 Hours)**

Includes all ten domains that make up the body of knowledge covered by the CISSP examination. Offers students an opportunity to obtain the knowledge and technical concepts required to achieve this certification. Topics include security management practices; access control systems; telecommunications and network security; cryptography; security architecture and models; operations security; applications and systems development; business continuity planning and disaster recovery planning; law, investigation, and ethics; and physical security. The CISSP certification is governed by the International Information Systems Security Certifications Consortium and is universally recognized as a key component in the selection process for management-level information security positions.

**ITC 6345. Systems and Network Administration. (3 Hours)**

Focuses on the skills, tools, and best practices required to provide and support computing infrastructure and services. Covers system installation and configuration, defining users and groups, user authentication, file systems, configuring and managing system and network services, client/server systems, and Web site administration. Also discusses troubleshooting, backup/recovery, security issues and policies, user/customer interaction, and the ethical and legal responsibilities of a system administrator.

**ITC 6355. Web Application Design and Development. (3 Hours)**

Introduces the development of Web applications. Topics covered include Web servers, Web application servers, Web application development methods, client-side and server-side scripting, and Web application development techniques. Offers students an opportunity to learn to construct and maintain a well-designed Web site and use state-of-the-art Web application development tools and languages to develop Web applications. Other topics include Web application security, session management, design patterns, and reusable Web application components.

**ITC 6400. Foundations of Informatics. (3 Hours)**

Introduces the fundamental properties of information, technologies, and people within an increasingly complex infrastructure and social system. Offers students an opportunity to learn theoretical foundations and applications of informatics and to explore technical and social issues—including policy choices, ethical issues, and legal obligations—with IT applications and solutions in various specific settings, such as business, education, healthcare, and government. Offers students a broad perspective and understanding of informatics as both a scientific field as well as a highly applied discipline in specific contexts that may help direct them to future career concentrations.

**ITC 6410. Fundamentals of Human Behaviors for Interactive Systems. (3 Hours)**

Introduces basic principles of cognitive and social psychology relevant to the design and use of interactive systems and applications. Offers students an opportunity to examine topics including human perception (e.g., how we identify, organize, and interpret information); human memory capacity and operation (e.g., how we recognize and recall information, and how we learn to develop skills and expertise); and human reasoning and decision making. Understanding how the human mind works and the limitation of our mental capacities may ultimately provide valuable insights to apply user-centered approaches in interface design as well as interactive systems development.

**ITC 6420. Introduction to Cloud Computing Applications and Management. (3 Hours)**

Offers an overview of theoretical and practical aspects of distributed systems and cloud computing. Cloud computing and web services are creating a huge demand for IT professionals to manage large-scale infrastructure and vast networks. Examines frameworks, techniques, and existing IT solutions to manage internet services at different levels (infrastructure, platform, and software) and to support the key characteristics of cloud computing, including virtualization, requirement for high reliability and security, extendability, and versatility.

**ITC 6450. Advanced Cloud Computing Applications and Management. (3 Hours)**

Offers a comprehensive learning experience in advanced concepts within cloud computing. Cloud computing has become a disruptive technology that has dramatically transformed the IT industry by offering scalability and delivery options that had not existed previously. Offers students an opportunity to gain an in-depth knowledge of concepts, programming models, virtualization options, file systems, architectures, storage, and secure computation, as well as to learn contemporary industry trends and what the future holds in the advanced concepts of cloud computing.

**Prerequisite(s):** ITC 6420 (may be taken concurrently) with a minimum grade of C-

**ITC 6460. Cloud Analytics. (3 Hours)**

Introduces students to a set of techniques, tools, and applications to help clients extract and harvest information from massive data (e.g., social media sites, e-commerce websites) through a cloud platform adopted by a business. Also introduces techniques to help clients migrate historical data to cloud systems, as new cloud systems provide contemporary analytics solutions. Offers students an opportunity to gain the technical strength to assist data analytics process and business intelligence in the context of a cloud computing platform. Cloud analytics is an emerging topic that helps establish a cloud computing service mode, aiming to assist and facilitate data analytics process through a public or private cloud.

**ITC 6480. Amazon Web Service (AWS) Cloud Architecting. (4 Hours)**

Exposes students to advanced technical topics to assist in the development of expertise in AWS cloud computing. Offers students an opportunity to gain the skills needed to pursue certification as an AWS Certified Solutions Architect–Associate, one of the most valuable IT certificates. Includes reading materials provided by AWS Academy, guided instruction in the classroom, hands-on labs operated by AWS, project work, and free practice exam if students wish to pursue certification after completing the course. Successful students have the ability to demonstrate knowledge and skills of how to architect and deploy secure and robust applications on AWS technologies.

**ITC 6490. Ethical Hacking. (3 Hours)**

Exposes students to the different phases of hacking, specific skills for penetration/intrusion testing, and demonstrates hands-on techniques in ethical hacking. Offers students an opportunity to gain technical capabilities to secure information systems and protect networks from hackers.

**ITC 6520. Network Protection and Cloud Security. (3 Hours)**

Studies technical tools to protect data, data privacy, information systems, and enterprise networks from external compromise. As enterprises evolve to handle speed, volume and types of data, enterprises must protect data, detect system compromises, and provide strategies for damage recovery. Students will have the opportunity to explore the field of cybersecurity, the body of technologies, processes, and practices designed to protect networks, devices, programs, and data from attack, damage, or unauthorized access. Offers students an opportunity to understand the components of a well-architected cybersecurity framework; to identify the tools required; and to create a plan that will protect the digital assets of the enterprise.

**Prerequisite(s):** ITC 6420 with a minimum grade of C-

**ITC 6530. Security Analytics. (3 Hours)**

Focuses on the knowledge and skills necessary to successfully handle security incidents based on real-time experience. Offers students an opportunity to analyze security risks, threats, and intrusion types as they develop security measures to protect an organization's computer networks and information systems. Studies how security analytics provide small, medium, and large organizations with visibility into complex attack techniques, such as data exfiltration, lateral movement, and compromised credentials. These cybersecurity skills are in high demand by employers.

**ITC 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ITC 6980. Capstone. (1-4 Hours)**

Offers students an opportunity to integrate their course work, knowledge, and experiences into a capstone project.

**Prerequisite(s):** ITC 6100 with a minimum grade of C- ; ITC 6150 with a minimum grade of C- ; ITC 6200 with a minimum grade of C- ; ITC 6250 with a minimum grade of C- ; ITC 6300 with a minimum grade of C-

**ITC 6983. Topics. (1-4 Hours)**

Covers special topics in information technology. May be repeated without limit.

**ITC 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**ITC 7995. Project. (1-4 Hours)**

Offers students a focused project experience to conduct in-depth research or produce a tangible product related to dominant topics in informatics. May be repeated up to three times for a maximum of 12 quarter hours.

**Insurance - CPS (INS)****INS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INS 6010. Insurance Finance. (3 Hours)**

Designed to provide students with a rigorous combination of theory and practice in the fundamental principles of finance for insurance. Offers students an opportunity to become familiar with many of the core principles and concepts commonly applied in the insurance field on a daily basis. Identifies and reinforces work-related practices, such as analyzing financial statements, the application of time value of money concepts, asset valuation on a discounted cash flow (DCF) basis, cost benefit analysis (CBA), and the quantification of the multifaceted relationship between risk and return in financial markets.

**INS 6020. Claims Management. (3 Hours)**

Introduces how claims are adjudicated in the insurance industry, focusing on specific steps and processes of principled claims management. Addresses the shifting technological landscape, exploring analytics as a tool for claim resolution and fraud detection, as well as providing information about the operational and regulatory environment in which claims are processed and managed. Reviews and evaluates case studies of all types of insurance and reinsurance. Illustrates how insurance regulations and compliance requirements have a significant, influential impact on the products sold and insurance carrier behavior in risk.

**INS 6030. Insurance Underwriting. (3 Hours)**

Introduces fundamental underwriting objectives and techniques across multiple lines of the insurance business—including life, health, accident, annuity, property, and casualty. Offers students an opportunity to learn how to apply risk analysis methodologies to pricing, negotiating, and client service. Integrates the most current tools and trends in analytics that have and will become essential to the underwriting process. Analyzes the impact of insurtech on the insurance industry, identifying applied practices that may transform underwriting. Examines decision science principles, to enable students to better understand how to select data for underwriting evaluation.

**INS 6040. Introduction to Insurance Data Analytics. (3 Hours)**

Offers an overview of analytics concepts and practices. Uses case studies of successful analytics initiatives within the insurance industry to examine how the collection and analysis of data impacts decision making. Introduces statistics for business analytics from an analysis-of-data viewpoint. Topics include frequency distributions; measures of location; mean, median, mode; measures of dispersion; variance; graphic presentation; elementary probability; populations and samples; sampling distributions; categorical data; continuous probability distributions; confidence intervals; and hypothesis testing. Offers students an opportunity to engage with the current theories, practices, and debates in the field of analytics to critically examine its practice for insurance industry professionals.

**INS 6050. Intermediate Insurance Analytics. (3 Hours)**

Builds on the foundation laid by INS 6040. Introduces fundamental data due diligence, reliability, data correction, and recoding processes and practices as they apply to the insurance industry. Expands upon the earlier introduced approaches to discerning and validating patterns in data through sound applications of the scientific method. Emphasizes regression, chi-square and ANOVA testing, regularization, and generalized linear models. Offers students an opportunity to obtain the fundamental data management, review, reengineering, and exploration skills required to successfully develop the data analytical competencies in demand across the insurance industry.

**Prerequisite(s):** INS 6040 with a minimum grade of C-

**INS 6080. Integrated Experiential Learning. (3 Hours)**

Offers students an application-oriented practicum in the development and delivery of insurance technology/analytics and management projects for tactical and strategic decision making in insurance organizations undergoing digital transformation. Offers students an opportunity to apply the principles, approaches, and tools to real-world problems in domain knowledge areas of insurance organizations and to develop and present analytical and management insights and recommendations for successful implementation of the sponsor project.

**INS 6110. Insurance Regulation and Law. (3 Hours)**

Offers students an opportunity to learn about insurance regulation at the state and federal level. Topics include the history and evolution of insurance regulation, federal and state regulatory practices, underwriting and claims regulation, and international insurance regulation.

**INS 6120. Macro Challenges in Insurance. (3 Hours)**

Studies the macro challenges facing the planet—including an aging population, climate change, and pandemic risks—and the way in which the insurance industry adapts and changes to address those challenges. From its deep-rooted understanding of risk assessment to its extensive access to and grasp of data, the insurance industry must vigilantly assess and respond to macro risks that threaten populations.

**Prerequisite(s):** INS 6010 with a minimum grade of C- ; INS 6030 with a minimum grade of C- ; INS 6040 with a minimum grade of C-

**INS 6130. Advanced Reinsurance. (3 Hours)**

Analyzes the fundamental mechanics of reinsurance, explaining how to use reinsurance to better create, pursue, and achieve core and strategic business goals. Students research the capital markets and how those financing sources evaluate the industry for investment purposes. Explores core aspects of reinsurance contract administration, as well as the financial management benefits and risks associated with reinsurance vehicles, markets, and partners, applying acquired knowledge to examples of uses and pitfalls to reinsurance purchasing.

**Prerequisite(s):** INS 6010 with a minimum grade of C- ; INS 6030 with a minimum grade of C-

**INS 6140. Distribution and Sales. (3 Hours)**

Introduces students to the traditional distribution and sales models used by the insurance industry. Examines contemporary disruptions to the traditional distribution and sales models brought on by the integration of data, machine learning, AI, and the trend toward online customer engagement. Offers students an opportunity to examine the impacts of these changes for individuals working in the distribution and sales segments of the insurance industry.

**Prerequisite(s):** INS 6040 with a minimum grade of C-

**INS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INS 6980. Capstone. (3 Hours)**

Offers an advanced application-oriented practicum in the development and delivery of insurtech/analytics and management projects for tactical and strategic decision making in insurance organizations undergoing digital transformation. Offers students an opportunity to apply the principles, approaches, and tools to real-world problems in domain knowledge areas of insurance organizations. Expect students to present analytical and management insights and recommendations for a successful implementation of their capstone project.

**INS 6983. Special Topics. (3 Hours)**

Covers special topics relevant to the Insurance industry. May be repeated up to three times.

## Interdisciplinary Studies - CPS (INT)

### **INT 2000. Experiential Project Preparation. (1 Hour)**

Designed to prepare students for an experiential learning placement. Encourages students to align academic goals with professional outcomes, course curriculum, and experiential learning opportunities. Offers students an opportunity to better understand key components of networks, business professionalism, and effective communication. Topics include resumé writing, defining a career field, assessing skills and abilities related to developing a career, and building cultural competency awareness. Asks students to develop a comprehensive, strategic job search plan along with effective related career documents. Introduces the College of Professional Studies' cooperative education and academic internship policies, procedures, and expectations.

### **INT 2964. Experiential Project. (0 Hours)**

Offers students an opportunity to apply their curricular learnings in an applied project setting. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review lessons learned, and incorporate suggestions from this review to improve and further develop their career development and professional plan. May be repeated twice.

**Prerequisite(s):** INT 2000 (may be taken concurrently) with a minimum grade of S

### **INT 2992. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

### **INT 4998. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

### **INT 5964. Projects for Professionals. (0 Hours)**

Offers students an opportunity to apply their curricular learnings in an applied project setting. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review lessons learned, and incorporate suggestions from this review to improve and further develop their career development and professional plan. May be repeated twice.

**Prerequisite(s):** INT 6200 with a minimum grade of S or EDU 6184 with a minimum grade of C-

### **INT 5965. Engaging with Industry Partners for Rising Professionals. (0 Hours)**

Offers students an enhanced applied project setting in which to apply their curricular learning. Working with a partner sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with the partner sponsor, and create a plan for implementing their recommendations. Curriculum supports students as they develop key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review lessons learned, and incorporate suggestions to improve and further hone their career development and professional plan. Career development opportunities through skill-building workshops, panels, and interview preparation are available. Partner-student interactions, including a culminating project presentation, allow partners to assess student potential for co-op, internship, or other employment opportunities with the partner. May be repeated two times.

### **INT 6000. Writing Lab. (1 Hour)**

Requires students to analyze and draft writing assignments from topics covered in graduate level courses.

**Corequisite(s):** CMN 6000

### **INT 6200. Experiential Project Preparation. (1 Hour)**

Designed to prepare students for an experiential learning placement. Offers students an opportunity to better understand key components of networks, business professionalism, and effective communication. Offers instruction in resumé writing; defining one's career field; assessing skills and abilities related to developing a career; building cultural agility, knowledge, and skills; and developing a comprehensive, strategic job search plan, along with effective career documents. Emphasizes alignment of academic goals with professional outcomes, course curriculum, and experiential learning opportunities.

**INT 6900. International Field Study Experience. (3-4 Hours)**

Seeks to prepare students for an increasingly global workplace and to help them gain a deeper understanding of current issues in their fields of study in an international context. Includes a period of required on-site instruction in the region of study. Offers students an opportunity to conduct in-depth field study based on specific themes pertinent to the locality and to meet with representatives from local organizations such as schools, businesses, the arts, government officials, and others. Culminates in a professional-quality research project or presentation. May be repeated up to two times.

**INT 6940. Experiential Learning Projects for Professionals. (1-4 Hours)**

Offers students an opportunity to apply knowledge and skills gained through their master's program to work on challenging short-term projects under faculty supervision. Students are matched with discipline-specific consulting projects provided by a wide range of sponsoring organizations in the private and nonprofit sectors. Students develop a project plan, conduct research, develop and deliver recommendations to sponsoring organizations, and reflect on lessons learned. Mapping academic course concepts and skills to the consultative process is a primary learning goal.

**INT 6943. Integrative Experiential Learning. (3 Hours)**

Offers students an opportunity to clarify their vision of a successful professional future, identify goals to achieve that vision, and assess career growth opportunities. Explores how to frame a growth strategy using internal and external scanning mechanisms, negotiation and persuasion, research, and critical reflection. Students refine an applied research topic, perform research, develop recommendations for addressing a key performance area within their existing workplace, and create a plan for implementing their recommendations. Students review "lessons learned" and incorporate suggestions from this review to improve and finalize their integrated plan. With permission from their host organization, students may go on to implement elements of their project in a current or upcoming project, where feedback is provided from stakeholders, including their corporate sponsor.

**INT 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Interdisciplinary Studies in Arts, Media, and Design (INAM)****INAM 1000. Arts, Media and Design at Northeastern. (1 Hour)**

Intended for freshmen in the College of Arts, Media and Design. Offers students an opportunity to become familiar with the liberal arts in general and with their major; to develop the academic skills necessary to succeed (analytical ability and critical thinking); to become grounded in the culture and values of the university community; and to develop interpersonal skills—in short, to familiarize themselves with all skills needed to become a successful university student. Requires advisor approval for students outside of the College of Arts, Media and Design.

**INAM 1300. The Politics of Narrative in Theatre. (3 Hours)**

Examines drama in everyday life—on stages, streets, and screens—and investigates the tribulations and promises of role-playing in ordinary narratives. Topics may include tragedy and trauma, identity and identification, catharsis and psychoanalysis, and the relationship between sacrifice and personal development. Interrogates how role-playing and drama—in all its forms—permeates our social relations. Experiments with rewriting the dramatic narrative of our everyday life experiences.

**Corequisite(s):** INAM 1301

**Attribute(s):** NUpath Ethical Reasoning

**INAM 1301. The Politics of Narrative in Theatre Seminar. (1 Hour)**

Accompanies INAM 1300. Engages in detailed discussions about the assigned readings and weekly topics.

**Corequisite(s):** INAM 1300

**INAM 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INAM 2000. Ethics in Creativity. (4 Hours)**

Studies the role of ethics in creative practice. Offers students an opportunity to reflect on many of the concerns creative professionals face, such as how creative practitioners manifest care as a social intervention for building intimacy, healing, and hope across communities and how to develop and articulate creative goals. From the rhetoric of trust and authenticity, to honesty and generosity, ethical concepts consistently make their way into creative practice. Examines (and affords students an opportunity to hone) strategies to systematically navigate uncertainty and iteration within creative practice, culminating in a student final creative project. Readings focus on ethical paradigms that illustrate how systems of power shape the role of creative practices in society.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Ethical Reasoning, NUpath Writing Intensive

**INAM 2183. Interdisciplinary Special Topics: Pop-up Course. (1,2 Hours)**

Addresses timely trends, issues, and events as they unfold. Offers students an opportunity to learn about and respond to issues of the day in an immersive, interdisciplinary, short-course format. Content and instructors vary by offering. May be repeated seven times for a maximum of 16 semester hours.

**INAM 2963. Topics. (1,2 Hours)**

Offers undergraduate students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering. May be repeated three times.

**INAM 2964. Experiential Project. (0 Hours)**

Offers students an applied project setting in which to apply their curricular learning. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review 'lessons learned' and incorporate suggestions from this review to improve and further develop their career development and professional plan.

**INAM 2973. Topics in Making. (1-4 Hours)**

Offers students an opportunity for early undergraduate-level examination of a subject in making. May be repeated for up to 16 SH.

**INAM 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INAM 2992. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**INAM 3200. Creative Cognition. (4 Hours)**

Offers a multidisciplinary exploration into the science of creativity. Many would agree that creativity is a cornerstone of human culture and innovation. But what is creativity, and how can humans cultivate it in life? Topics include idea generation and evaluation, problem solving and insight, psychometric measurements of creativity, the role of creativity in the arts and in human resource management, and the complex relationships between creativity and mental health. Synthesizing a variety of perspectives in creativity research, offers students an opportunity to train themselves to become more creative thinkers and practitioners.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Creative Express/Innov

**INAM 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INAM 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INAM 4998. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**INAM 5000. Introduction to Creative Computing. (4 Hours)**

Introduces foundational concepts of computational media art, focusing on the use of computational processes for the creation of interactive and generative experiences. Students use data and mathematical procedures to generate images, express ideas, and create meaning. Offers students an opportunity to obtain practice-based experience with the benefits and limitations of using computational processes, reflecting on what computers can and cannot do well. Uses computational procedures and concepts such as automation, recursion, and data processing for creative purposes. Students create computational media projects using code and/or other media such as photography, video, performance, installation, etc.

**INAM 5183. Interdisciplinary Special Topics: Pop-up Course. (1,2 Hours)**

Addresses timely trends, issues, and events in the fields of arts, media and design as they unfold. Offers students an opportunity to learn about and respond to issues of the day in an immersive, interdisciplinary, short-course format. Includes emphasis on experiential forms of teaching and learning. Content and instructors vary by offering.

**INAM 5240. Make Your Mark: Trademark and Advertising Law in Creative Industries. (4 Hours)**

Introduces trademark, branding, and advertising and endorsement law through the lens of the music industry and other creative industries. Approaches these areas of law through a combination of materials that may include statutory and case law, administrative agency guidance, pending legal disputes and current events, problems and hypotheticals, sample transactional documents, and student presentations. Covers trademark use, distinctiveness, and protectability; trademark infringement and dilution; false advertising law; FTC regulations on advertising and endorsement; and right of publicity law. Explores how law and industry norms shape practices and outcomes with the goal of preparing students entering creative industries to form strategies and make decisions related to these areas of law as they arise.

**Attribute(s):** NUpath Societies/Institutions

**INAM 5300. Principles of Design. (2 Hours)**

Introduces the foundational essential components of the design process, investigates key concepts in historical and contemporary design practice, and includes applied practice to illustrate the way expert designers think, collaborate, and create. Core content focuses on a broad range of design applications across industry sectors to improve intellectual dexterity and provide a range of interdisciplinary skills and knowledge.

**INAM 5305. User Observation and Design Planning. (2 Hours)**

Introduces the theory and methods of behavioral observation, description, and analysis. Covers the methodologies and tools for conducting quantitative and qualitative user research, including surveys, persona development, customer journey maps, and other industry-standard tools for studying user experience. Course content focuses on the general forces acting upon an organization, such as competition, technological breakthroughs, diverse information channels, demographic shifts, and how practitioners are using design to proactively respond to these forces.

**Prerequisite(s):** INAM 5300 with a minimum grade of C

**INAM 5310. Principles of Creative Collaboration. (2 Hours)**

Studies methods for recognizing and removing personal creative blocks, techniques for strengthening communication skills in a team-based environment, as well as active listening skills to amplify the ideas of others. Increasingly complex organizations require teams to boldly navigate uncertainty, leverage the power of diverse perspectives, and collaborate effectively to uncover innovative ideas. This course builds upon these concepts.

**INAM 5400. Facilitating Creative Collaboration. (2 Hours)**

Explores the different types of roles that individual contributors may take in team-based environments; methods for navigating challenging situations to improve team productivity; and techniques for strengthening leadership, communication, and collaborative skills. Successful leaders leverage a variety of techniques and tools to discover, understand, and maximize the ways in which teams interact, communicate, and collaborate. At the conclusion of the course, students should be able to develop and execute action plans by applying these practices for optimum team productivity and output.

**Prerequisite(s):** INAM 5310 with a minimum grade of C

**INAM 5405. The Agile Mindset and Design-Led Innovation. (2 Hours)**

Focuses on approaches to problem solving that are human centered and guided by the underlying principles of adaptability, collaboration, design, and creativity. Grounded in both theory and applied practice, offers students an opportunity to learn techniques for building their own adaptive capacity, crafting and communicating a strong vision, applying a framework for distributed leadership, engaging and empowering team members, and codesigning solutions that require shifts in beliefs and practice.

**INAM 5410. Persuasion and the Power of Storytelling. (2 Hours)**

Explores the basic theory of persuasive communication, including models of information processing, motivational appeals, message acceptance, fast and slow decision making, and rules of effective human interactions. Effective leaders across organizations possess the ability to engage, inspire, and challenge teams through authentic connection and clear communication. Compelling stories help to make sense of complexity, engage the audience emotionally, and call others to action. Offers students an opportunity to learn to frame the problem, consider audience motivations, utilize compelling and dramatic narrative construction, convey complex information orally and visually, and generate emotional appeal and action.

**INAM 5415. Design Studio: Fundamentals of Iterative Prototyping. (2 Hours)**

Analyzes the different types of prototypes and the logic for when and how to employ each technique when testing distinct assumptions. Covers prototype selection; the methods for prototyping ideas and testing underlying assumptions; implementing prototypes to discover, communicate, and validate; and techniques for executing and testing ideas. Offers students an opportunity to learn the need for rapid innovation, resiliency, and gracefulness in the face of frequent failure situations.

**INAM 5420. The Creative Process. (4 Hours)**

Explores several themes that stimulate creativity in individuals and teams. Analyzes the notion of creativity, including defining creativity, understanding how it is measured, and analyzing processes of creativity across multiple disciplines and industry sectors. Delves into the mechanics of creativity to explore how the most innovative thought leaders have revolutionized their industries and left a lasting impact on the world. Offers students an opportunity to explore their own creativity and professional applications to align their creative process with scientifically proven strategies. Students work with a variety of teams on assignments throughout the course to foster collaboration and learning.

**INAM 5425. Design Methodology. (4 Hours)**

Explores the mindset, skill set, and tool set associated with design. The content is oriented toward practical methods for approaching a design problem holistically to help frame and solve challenges with a wide range of applications across industry sectors. Includes approaches to noticing and observing, framing and reframing, imagining and designing, and experimenting and testing. Introduces concepts of user experience (UX) design, user interface (UI) design, and system design to provide a strong foundation for future coursework.

**INAM 5430. The Improvisational Mindset. (2 Hours)**

Studies the essential skills to becoming a more authentic and dynamic leader by learning to read situations accurately, make well-calibrated and appropriate responses for different audiences and circumstances, as well as lead with more confidence and empathy. Offers students an opportunity to develop a broader leadership tool kit, including the ability to adapt to shifting landscapes, business challenges, and unanticipated situations with agility, spontaneity, and creativity.

**INAM 5435. Multidisciplinary Collaboration and Creative Engagement. (2 Hours)**

Focuses on helping students conceive design solutions through analyzing assumptions, intuition, and working through iterative sequences in a team-based environment to generate creative outcomes. Central to this course is an acknowledgement of the limitations of individuals and singular disciplines and the need for collaboration that includes diverse perspectives. Successful leaders leverage a variety of techniques and tools to discover, understand, and maximize the ways in which teams interact, communicate, and collaborate. Topics include team formation, leading teams, decision making as a group, gathering diverse perspectives, testing assumptions, and managing conflict.

**INAM 5440. Organizational Storytelling and Public Relations. (2 Hours)**

Explores theoretical and practical competence in organizational branding, promotion, and public relations. Presents the practical and analytical skills needed to envision promotional strategies, community engagement efforts, and marketing materials by leveraging user experience design across both traditional and digital environments.

**INAM 5445. Inclusive Communication and the Power of Diverse Networks. (2 Hours)**

Offers students an opportunity to learn how to create a shared purpose, strengthen engagement, foster generative learning, and leverage the power of differences in a team-based environment where a diversity of ideas is actively encouraged. Matrixed companies are leveraging more cross-functional, flexible teams to work on short-term projects. Diverse networks of relationships provide webs of support while offering new perspectives that spur innovation and growth. This course explores these themes in depth through applied practice.

**INAM 5500. Adaptive Leadership. (2 Hours)**

Explores the power of discovery as a driving force for uncovering emergent strategies, how to adapt to changing circumstances in a team-based environment, methods for creating and articulating strategies that are flexible and scalable, and how to collaboratively lead teams in order to solve problems that address required change. Adaptive leadership enables managers and their organizations to rapidly and efficiently shift strategy in direct response to changing internal and external circumstances.

**INAM 5505. Dynamic Multichannel Communication. (2 Hours)**

Covers the practical tools to improve clarity when articulating new ideas, how to command the attention of any audience, and distinctive communication styles tailored to digital and virtual formats. New platforms and technology innovations have allowed individuals to share user-centered, dynamic, and practical information through personalized, engaging, and digestible messages. Video conferencing has also evolved to change the way we connect with peers, colleagues, and external audiences. Offers students an opportunity to learn how to hone more effective communication skills tailored to these evolving mediums using creative and adaptable techniques based upon research and proven methods.

**INAM 5507. Foundations of Data Visualization. (1 Hour)**

Establishes the conceptual models of data visualization and information design with respect to data analysis and examines the implications of these models for the visualization practice. Distinguishes and articulates what makes a successful visualization and which pitfalls to avoid. Draws insights from research in visual perception and examines design strategies to organize information. Identifies improvements to existing visualizations and formally evaluates visualizations in user studies.

**INAM 5508. Visual Data Encodings. (1 Hour)**

Examines visualization strategies for common data types, focusing on the visualizations that are appropriate for specific research questions and data types. Focuses on visualization methods for one-to-n-dimensional data sources and examines the many different ways to express time and duration. Identifies interactive techniques to support the discovery of patterns, filter through data to isolate meaningful data points, and explore connections between multiple data sources.

**Prerequisite(s):** INAM 5507 (may be taken concurrently) with a minimum grade of B or INAM 5507 (may be taken concurrently) with a minimum grade of B

**INAM 5510. Data-Driven Storytelling. (2 Hours)**

Offers practical methodologies for detecting and articulating the stories behind datasets and how to communicate data findings in visual, oral, and written contexts. Covers select topics in data-driven storytelling projects across industry sectors and provides practical tools for navigating the often-competing demands of rigorous analysis and accessible narrative and storytelling. Designed to foster moderate technical learning of applications and software. Incorporates theories from relevant fields in data visualization and data science and emphasizes storytelling for broad public audiences.

**INAM 5515. Ethics and Creative Innovation. (4 Hours)**

Explores questions of ethics and organizational responsibility as they relate to innovative and creative endeavors. Introduces the theories and methods used in ethical decision making with application across industry sectors. The heightened focus on fairness, trust, accountability, and transparency requires organizations to critically examine their innovative practices to ensure they are safe, inclusive, and socially responsible. Offers students an opportunity to learn about key strands of understanding in these areas, to reflect on their views in relation to current debates, and to hone strategies to systematically navigate uncertainty and iteration within creative practice. Focuses on ethical paradigms to illustrate how systems of power shape the role of creative practices in society. Requires a final creative project.

**INAM 5520. User Experience and Emerging Technologies 1. (2 Hours)**

Explores emerging digital interfaces and technology. Ongoing reliance on computer interfaces and emerging technologies—including virtual reality (VR), augmented reality (AR), voice user interfaces (VUI), and artificial intelligence (AI)—are growing rapidly and impacting the way we connect with colleagues and customers alike. The advances in artificial intelligence and voice technologies have enabled the creation of platforms and tools that support conversational interactions between people and devices. Offers students an opportunity to obtain an understanding of the tools that will continue to transform user experience across industries and how human-computer interaction has influence across application domains and industry sectors to improve their collaborative work with peers and colleagues, as well as their connection with customers.

**INAM 5525. Fundamentals of Systems Design 1. (2 Hours)**

Explores the structures and processes for the design of systemic relationships between people, artifacts, environments, and activities. Systems may be physical, virtual, social, or a combination. Covers the principles of systems theory and explores the connection between design methods and systems thinking. Addresses the questions that are fundamental to design practice: What is a system and what are the different types? How do we observe, analyze, and represent systems? What interactions can we have with systems and what are the different types of interaction?

**INAM 5963. Topics. (1,2 Hours)**

Offers students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering.

**INAM 5964. Projects for Professionals. (0 Hours)**

Offers students an applied project setting in which to apply their curricular learning. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review 'lessons learned,' and incorporate suggestions from this review to improve and further develop their career development and professional plan. May be repeated two times.

**INAM 5965. Engaging with Industry Partners for Rising Professionals. (0 Hours)**

Offers students an enhanced applied project setting in which to apply their curricular learning. Working with a partner sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with the partner sponsor, and create a plan for implementing their recommendations. Curriculum supports students as they develop key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review lessons learned, and incorporate suggestions to improve and further hone their career development and professional plan. Career development opportunities through skill-building workshops, panels, and interview preparation are available. Partner-student interactions, including a culminating project presentation, allow partners to assess student potential for co-op, internship, or other employment opportunities with the partner. May be repeated two times.

**INAM 5973. Topics in Making. (1-4 Hours)**

Offers students an opportunity for advanced undergraduate- or graduate-level examination of a subject in making. May be repeated for up to 8 SH.

**INAM 5976. Directed Study. (1-4 Hours)**

Offers directed study of a specific topic not normally contained in the regular course offerings but within the area of expertise of a faculty member. May be repeated seven times for a maximum of 32 semester hours.

**INAM 5983. Interdisciplinary Special Topics. (3,4 Hours)**

Addresses timely trends, issues, and events. Offers students an opportunity to learn about and respond to issues of the day in an immersive, interdisciplinary format. Content and instructors vary by offering. May be repeated nineteen times.

**INAM 6000. Interdisciplinary Critique Studio. (4 Hours)**

Builds critical analysis skills and introduces students to rigorous artistic dialog. Offers direct, focused feedback on specific student projects. Feedback is conceptual and technical, serving to push the work forward and give students a critical perspective on how their work functions in the world. Offers students the time and the resources to work on long-term projects and to research and develop a more individual body of work. Also provides an opportunity to network, providing an introduction to professional practices in the visual arts, such as exhibiting art works, applying for grants, and teaching.

**INAM 6100. Critical Foundations of Creative Practice. (4 Hours)**

Introduces core theoretical foundations of the creative practice and creativity studies fields. Considers interdisciplinary, contemporary, and critical frameworks alongside themes such as creative economies; performance and reception studies; placemaking; social and ecological justice; critical race and gender studies; and the intersection of ethics, culture, politics, and public policy around modes of creative practice.

**INAM 6200. Topics in Communication Strategies. (4 Hours)**

Explores methods and techniques of professional writing to build creative narratives for cultural leaders as well as written and nonwritten communication. Covers strategies for advocacy, including artists/program notes, grant opportunities, business plans, blogs, op-eds, new media, marketing/promotion, and strategic positioning. Offers students an opportunity to develop a portfolio of documents (written and nonwritten) to establish a core for future communication platforms.

**INAM 6210. Projects in Interdisciplinary Creative Practice. (4 Hours)**

Focuses on project management and assessment for creative projects and related entrepreneurial enterprises; critiques of creative work and creative organizing projects; analysis and application of multiple forms of assessment of the professional practice; and planning for intellectual property, branding, and marketing challenges. Offers students an opportunity to learn how to articulate and implement medium-to-long-range strategies for reaching next career stages and achieving larger goals in their creative enterprises.

**INAM 6300. Models for Applied Inquiry in Creative Practice. (4 Hours)**

Focuses on thoughtful engagement with diverse and emerging forms of critical inquiry, professional engagement, and creative practice for artists, entrepreneurs, and administrators. Through course work and interaction with leading practitioners, offers students an opportunity to gain an understanding of the impact that forms of production and business models have on potential contribution to fields of critical practice and their diverse culture, while developing innovative models for their own creative, critical, and entrepreneurial endeavors.

**INAM 6301. Integrative Research Project. (4 Hours)**

Offers students an opportunity to work independently on a research project of choice that integrates two or more creative disciplines. The research project results in students crafting their artist statement.

**Prerequisite(s):** INAM 6300 with a minimum grade of B-

**INAM 6360. Ethnographic Methods and the Arts. (4 Hours)**

Considers what ethnography might teach us about creative industries, what it contributes to marketplace research and decision making, and how it informs creative practice. Ethnography uses participant/observation and other methods of collecting qualitative data to research specific social groups and their cultures. Asks for what purposes ethnographic methods are best suited and how ethnography might contribute to cross-cultural understanding, arts leadership, and creative practice. Covers what unique methodological issues ethnographic research in the arts might pose. Offers graduate students an opportunity to develop, with faculty guidance, an original research proposal and independently practice ethnographic methods.

**INAM 6430. AI and Creative Exploration. (4 Hours)**

Offers students an opportunity to learn how to use off-the-shelf technologies (i.e., prompt engineering for generative AI platforms) and to design AI systems on their own using web interfaces, Python frameworks, cloud-based GPUs, etc. Combines technological training with a critical analysis of AI-based artworks. Designed to help students integrate AI tools and methods into their existing practice. The projects are student driven and should serve to further the students' own research and creative practice. No limitations are placed on the field of application (e.g., visual arts, moving images, games, sound, writing, dance, and movement); however, strongly emphasizes the ethical and socioeconomic impact of AI tools on society—both within and beyond the boundaries of art.

**Prerequisite(s):** INAM 5000 with a minimum grade of C

**INAM 6500. Communication for Social Change. (2 Hours)**

Examines the communication strategies employed by national and international organizations, including rhetorical messaging, public advocacy, grassroots organizing, fundraising, and media outreach efforts. Consumers are increasingly interested in an organization's stance on social and political issues. The digital age has provided new ways to access information and support brands that embody the values of diversity, equity, inclusion, and a net positive impact on social movements. Analyzes the platforms these organizations have chosen, the importance of authentic transparency, and how these concepts may be integrated into the core values of any organization regardless of industry sector.

**INAM 6505. User Engagement and Experience Design. (2 Hours)**

Examines the potential of interfaces as mediators between information and users. Covers the fundamentals of user experience design (UX) and the foundations for interaction design. Explores iterative prototyping and research methods to analyze patterns of behavior and implications of interface on effective communication. Includes utilizing observation, empathy, ethnography, and participatory design methods to offer students an opportunity to increase their understanding of audience and stakeholder motivations and expectations.

**INAM 6510. User Engagement and Organizational Communication. (2 Hours)**

Studies sensitivity to the needs and goals of various stakeholders in order to design integrated communication messaging to maximize impact and engagement across channels. New workplace trends and the changing technological landscape make it clear that connecting with others to exchange knowledge and ideas is a crucial element of success. New digital platforms, corporate team collaboration sites, and social media networks are making it easier than ever to connect with colleagues and external audiences across the globe.

**INAM 6515. Design Studio: Multidisciplinary Projects. (2 Hours)**

Focuses on the development of systems, artifacts, communication, and service offerings tailored to the unique personal experience of the audience. Covers a range of research methods, ideation processes, and theoretical frameworks to help students make reasoned judgments when facing complicated situations. Students work in research teams to solve complex multidisciplinary projects requiring iterative, collaborative, and innovative approaches.

**Prerequisite(s):** INAM 5415 with a minimum grade of C

**INAM 6520. User Experience and Emerging Technologies 2. (2 Hours)**

Continues the exploration of how immersive technology is revolutionizing the relationship between organizational storytellers and their audiences. Covers virtual reality video formats as a powerful tool providing a 360-degree view of the story to engage multiple audiences. Lab work explores new immersive augmented and mixed-reality formats for publication, exhibition, or other form of information distribution. Offers students an opportunity to learn immersive storytelling concepts using artificial intelligence and machine learning.

**Prerequisite(s):** INAM 5520 with a minimum grade of C

**INAM 6525. Fundamentals of Systems Design 2. (2 Hours)**

Introduces system modeling methods for representing different types and aspects of systems including continuous models, discrete models, probabilistic models, and structural models. System modeling and simulation software packages are used to understand and predict system behavior. Various forms of physical prototyping are also applied as complementary methods to understand, analyze, explore, and evaluate systems through the development process.

**Prerequisite(s):** INAM 5525 with a minimum grade of C

**INAM 6530. Emerging Practices in Technology and the Arts in Context. (4 Hours)**

Exposes students to a range of new tools and techniques for making art in a contemporary interdisciplinary framework. Explores how digital technology is reshaping artistic methodologies, affinities, and ways of making. Enriches existing student creative practices and encourages expansion into new, interdisciplinary territories. Includes guest lectures, performances, and off-site visits as well as studio workshops, discussions, and critiques.

**INAM 6900. Interdisciplinary Capstone. (4 Hours)**

Offers students an opportunity to work on real-world, open-ended projects proposed by industry partners and university research centers. Students work in diverse teams as they apply creativity, collaboration, and design concepts to conceptualize the problem, define functional requirements, identify risks and countermeasures, and prototype solutions.

**Prerequisite(s):** INAM 5415 (may be taken concurrently) with a minimum grade of C

**INAM 6976. Directed Study. (1-4 Hours)**

Offers directed study of a specific topic not normally contained in the regular course offerings but within the area of expertise of a faculty member. May be repeated without limit.

**INAM 7000. Introduction to Research in Interdisciplinary Design and Media. (4 Hours)**

Offers an overview of different forms of art and design research. Designed to guide students in crafting a plan for navigating their own individual path through the program. Creates a shared vocabulary for interdisciplinary research and sets expectations for the remainder of each student's highly individualized path. Throughout the semester, the class reads and discusses key texts on interdisciplinary arts and design and media research; researches and reports on case studies of other research that relates to the direction of their research, including dissertations by prior students from CAMD and other institutions; and participates in guest presentations/discussions by program faculty regarding the integration of research and practice.

**INAM 7001. Research Methods in Interdisciplinary Design and Media. (4 Hours)**

Offers an overview of research designs and methods across disciplines. Discusses how to select and use these methods and strategies and discusses IRB procedures. Includes guest presentations from faculty across the campus. This course is not meant as a comprehensive methodological training but rather an overview that should be complemented with at least one specialized methods course from a university-wide list of courses in the first semester of study and two others in the second semester of study.

**INAM 7100. Thesis Proposal. (4 Hours)**

Offers students an opportunity to develop and present a proposal for a topic of study/research based on their creative disciplines to a faculty committee for approval. Requires a definition of the scope of the project, a description of the interdisciplinary nature of the work, the methodologies for the research, and the assumptions being questioned or analyzed. The thesis research proposal must demonstrate the student's ability to carry out independent interdisciplinary creative practice research.

**Prerequisite(s):** INAM 6301 with a minimum grade of B-

**INAM 7900. Research Seminar. (4 Hours)**

Requires students to present their work in progress for feedback by their peers, faculty, and visitors. The work conducted in this seminar serves as the foundation for establishing the topic and method of study employed for the dissertation.

**INAM 7901. Dissertation Writing Seminar. (4 Hours)**

Introduces and discusses conventions in dissertation writing such as structure, contextualization, argumentation, tone, formality, and citation styles. Development of a thesis proposal and honing the project's methodology is the main function of this course. Offer students an opportunity to continue developing publishable scholarly work that is associated with the dissertation project.

**INAM 7990. Thesis. (4 Hours)**

Offers the candidate, working with a thesis advisor, an opportunity to continue to complete the research project defined and proposed in INAM 7100. The research is carried out in an independent manner, with periodic presentations to the thesis committee. These presentations define the benchmarks for determination of successful progress in the project. The ultimate result is an exhibition, screening, performance, or other form of public display or presentation, together with a thesis paper or written corollary.

**Prerequisite(s):** INAM 7100 with a minimum grade of B-

**INAM 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers continued work on the thesis project.

**Prerequisite(s):** INAM 7990 with a minimum grade of B-

**INAM 8984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated up to three times for a maximum of 16 semester hours.

**INAM 8986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated up to nine times.

**INAM 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of program requirements for PhD candidacy.

**INAM 9700. Dissertation Fieldwork. (0 Hours)**

Offers students an opportunity to pursue experiential research outside the classroom and outside the university.

**INAM 9980. Experiential PhD Research Residency. (0 Hours)**

Comprises a research residency experience in an organization whose mission and activities are aligned with the College of Arts, Media and Design PhD program. The research residency is designed to help develop dissertation ideas or research papers or to obtain access to resources helpful to dissertation development or research. A faculty member serves as an advisor for the residency experience, but individuals within the organization in which the student is working are asked to serve as formal mentors for the student residency experience. May be repeated two times.

**INAM 9990. Dissertation Term 1. (0 Hours)**

Offers dissertation supervision by individual members of the department.

**Prerequisite(s):** INAM 9000 with a minimum grade of S

**INAM 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by individual members of the department.

**Prerequisite(s):** INAM 9990 with a minimum grade of S

**INAM 9996. Dissertation Continuation. (0 Hours)**

Offers dissertation supervision by individual members of the department.

**Prerequisite(s):** INAM 9991 with a minimum grade of S

**Interdisciplinary Studies - Mills College at Northeastern (INMI)****INMI 1051. Introduction to Ethnic Studies. (4 Hours)**

Introduces students to the field of Ethnic Studies for students interested in learning about race, racial inequality, and social justice. Provides students with the theoretical and analytical tools to understand, deconstruct, and apply theories of race and ethnicity. Deeply reviews the historical context in which Ethnic Studies emerged as an academic discipline. In examining the major theories and concerns of Ethnic Studies and in particular the origins of racism and the relationship between academic learning and community activism, students are offered the opportunity to investigate the intersections of race, class, gender, and other axes of difference in shaping identities and political/structural conflict.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions, NUpath Writing Intensive

**INMI 1100. Problem Solving for a Sustainable Future. (4 Hours)**

Presents a skills-based, interdisciplinary introduction to sustainable problem solving. Explores foundational problem-solving competencies and applies them to real-world case studies that investigate the interconnectedness of social, economic, and environmental systems. Studies how to analyze complex problems and propose actionable solutions that promote resilience, well-being, justice, and balance across communities, institutions, and ecosystems.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**INMI 1802. Gentrification and Strategies of Community Preservation. (4 Hours)**

Delves into effective strategies employed by communities and city planners to mitigate the adverse impacts of gentrification. Explores the root causes and repercussions of gentrification, along with community-driven solutions and policy interventions. Focuses on the city of Oakland, emphasizing the intersection of race and the contentious relationship between gentrification and displacement. Addresses various forms of stratification associated with gentrification including class inequality, escalating housing costs, homelessness, and their interconnectedness with market forces and urban planning. Scrutinizes Oakland's decline and redevelopment within a broader structural context, contextualizing its gentrification process in relation to analogous trends observed in numerous cities across the United States and globally. Accentuates entrepreneurial approaches to addressing these issues.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**INMI 1803. Technologies of Race and Gender. (4 Hours)**

Presents an interdisciplinary U.S.-based study of technologies that develop and function, over time, to create, maintain, and enforce ideas about race and gender. Explores an understanding of these mutually informed systems of knowledge as technologies with both positive and harmful ideological and material effects. Topics include shifts in scientific and medical thinking, the rise in social scientific thought, trends in popular cultural representations, modes of state surveillance, and the contemporary rise of data science. Examines complex consequences of these technologies alongside critical responses, and resistance to, these forms of power. Builds on large-scale and national historical overview to consider case studies drawn from Bay Area political, social, and cultural histories. Culminates with group projects focused on complex, present-day intersections of race, gender, and technology.

**INMI 1877. Race, Public Health, and Storytelling. (4 Hours)**

Explores the interrelated topics of race, policy, and storytelling in public health contexts. Investigates how narratives inform policymaking, racial implications within social problem conditions, and draws connections to public policy outcomes. Examines the role of storytelling for analyzing and presenting these topics. Offers students an opportunity to explore and generate diverse and creative policy solutions through their deep reflection and analysis of race relations and conditions, health policymaking, and storytelling practices.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**INMI 2126. Theories of Race and Ethnicity. (4 Hours)**

Exposes students to the cutting edge of critical thinking around issues of race and ethnicity. Examines how to unpack “commonsense” ideas about race and inequality. Uses theory as a tool to offer students an opportunity to develop critical thinking, a new vocabulary, and a framework for understanding the history and contemporary impact of race within the United States and in a global context. Analyzes how race has been theorized by a range of thinkers, and explores new knowledge about the interactions between race, ethnicity, immigration, gender, class, and sexuality. As a final project, students articulate their own intellectual and activist calling and consider how theory can inform their academic, political, and personal futures.

**Prerequisite(s):** INMI 1051 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions, NUpath Writing Intensive

**INMI 2183. Interdisciplinary Special Topics: Pop-up Course. (1 Hour)**

Addresses timely trends, issues, and events as they unfold. Offers students an opportunity to learn about and respond to issues of the day in an immersive, interdisciplinary, short-course format. Content and instructors vary by offering. May be repeated twice.

**INMI 2220. Women, Gender, and Cultural Production in the Global South. (4 Hours)**

Explores the intersections of race, class, gender, sexuality, power, and resistance. Critically engages students with cultural productions in the Global South. Studies the intellectual and social roots of cultural systems and the relationship between culture, gender, identity, and social change. Examines how various cultural mediums reject and resist identity, social change, and structural injustices. Analyzes transnational cultural dynamics by emphasizing the role of gender and sexuality in shaping cultural narratives and their societal impacts. Major topics include hijra activism and transgender identity, Dalit testimonials, antiwar documentary filmmaking, indigenous history, docudrama, grassroots organization, and decolonial artistic resistance.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**INMI 2300. Systematic Botany. (4 Hours)**

Introduces the evolutionary history and diversity of plants, including phylogenetics, classification, taxonomy, nomenclature, biogeography and evolutionary processes (speciation and convergence) as they relate to angiosperms (flowering plants), gymnosperms (cone-bearing plants), seedless vascular plants (ferns), and nonvascular plants (mosses, liverworts, hornworts). Practices the use of the tools of systematics (including the use of dichotomous keys) and interpretation of phylogenetic trees.

**Prerequisite(s):** BIOL 1107 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- or BIOL 1113 with a minimum grade of D- or EEMB 1101 with a minimum grade of D- or EEMB 1105 with a minimum grade of D- or EEMB 2302 with a minimum grade of D- or EEMB 2400 with a minimum grade of D-

**Corequisite(s):** INMI 2301

**Attribute(s):** NUpath Natural/Designed World

**INMI 2301. Lab for INMI 2300. (1 Hour)**

Accompanies INMI 2300. Focuses on application and practice of ideas presented in lecture as students practice and develop the skills of systematics, master the vocabulary of botany, and analyze data and draw appropriate, evidence-based conclusions from the published literature.

**Corequisite(s):** INMI 2300

**INMI 2321. Research Methods in Sociology. (4 Hours)**

Introduces students to the range of research methods used by sociologists. Covers experimental research, field research, survey research, and historical-comparative research. Discusses sampling, the rules of evidence in empirical research, research ethics, and the place of values.

**Prerequisite(s):** SOCL 1101 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**INMI 2500. California in Global Economy: Business, Policy, and Beyond. (4 Hours)**

Examines the key sectors of California's economy and discusses their positionality within the global landscape. Presents conceptual foundations and frameworks drawing on strategic management, disruptive innovation, and political economy literatures. Provides students with in-depth sectoral knowledge and exposure to innovation diffusion trends relevant to California's economy and the world. Offers students an opportunity to learn about business and industry clusters specific to California and to develop an understanding of how California fits into and affects the world economy. Emphasizes the interactions of workforce diversity, radical innovation, and human resource management. Also discusses concepts relating to global talent flows, platform economies, network economies, and go-to-market strategies.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**INMI 2510. China, Globalization, and the Environment. (4 Hours)**

Explores the global impacts of China's reemergence as an economic, technological, and political leader. Takes a political ecology approach to examine chains of production and consumption connecting China with the rest of the global economic system. Discusses how global trade affects people and the environment where products are made, how U.S. and global trade policies shape international development, and how consumer choices can have wide-ranging environmental consequences.

**Attribute(s):** NUpath Societies/Institutions

**INMI 2550. Sustainability in the Beauty Industry. (4 Hours)**

Offers an interdisciplinary introduction to sustainability within the beauty industry. Examines challenges and opportunities in creating and marketing products that are environmentally responsible, ethical, and socially conscious. Explores scientific principles underlying sustainable formulation, the environmental impact of ingredients and packaging, and the social implications of beauty industry practices. Emphasizes systems thinking and ethical reasoning as students analyze how scientific innovation, environmental stewardship, and social responsibility can converge to transform traditional beauty industry paradigms.

**Attribute(s):** NUpath Ethical Reasoning

**INMI 2700. Transformative Justice Through Computing Technology. (4 Hours)**

Explores social impact through the intersection of transformative justice and computer science. Examines how technology can be leveraged to confront issues related to justice, community empowerment, and social transformation. Actively engages students in applying transformative justice approaches to addressing institutionalized disparities suffered by previously incarcerated women and nonbinary individuals of color. Provides hands-on support through development and deployment of technology-based solutions such as extended reality to aid these individuals in successfully acclimating to life outside of prison and gaining equitable access to technology learning.

**Attribute(s):** NUpath Difference/Diversity

**INMI 2710. Social Impact Consulting and Artificial Intelligence. (4 Hours)**

Engages student teams in actively crafting innovative solutions to critical social challenges. Students work directly with mission-driven entities to provide analyses, recommendations, strategies, and assessments critical to growth, viability, and impact. Emphasizes the equitable, responsible, and effective application of artificial intelligence tools and other frontier technologies to enhance problem-solving approaches and drive data-informed decision making. Offers students an opportunity to gain a richer perspective on catalyzing social impact; develop skills in communication across social, cultural, and disciplinary boundaries; and apply sound leadership and decision-making principles within diverse environments. Provides hands-on support to entrepreneurs, initiatives, and organizations in local communities and beyond.

**Attribute(s):** NUpath Difference/Diversity, NUpath Integration Experience

**INMI 2810. Sustainability and Persuasion. (4 Hours)**

Presents research and theories on changing individual and institutional behavior related to environmental sustainability and personal well-being. Introduces research on attitude change, attitude-behavior relations, persuasion and compliance principles, and resistance and obstacles to behavior change in both individuals and society. Exposes students to scientific case studies of educational and behavior change programs in sustainability and well-being. Offers students an opportunity to develop programs and campaigns to improve sustainability and well-being.

**Prerequisite(s):** PHTH 1260 (may be taken concurrently) with a minimum grade of C or PHTH 1261 (may be taken concurrently) with a minimum grade of C or PSYC 1101 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Natural/Designed World

**INMI 2820. Climate Change, Health, and Resilience. (4 Hours)**

Examines how human behavior contributes to both climate change and chronic disease and how climate change exacerbates poor health trends and inequities, creating new health risks in the United States and around the globe. Considers the health impacts of environmental changes, such as changing temperatures, extreme events, and scarcity of resources. Presents strategies for building resilience and considers steps to adapt to and mitigate climate change that mutually enhance the health of individuals, communities, and the environment.

**Prerequisite(s):** AFCS 1270 (may be taken concurrently) with a minimum grade of C or AFRS 1270 (may be taken concurrently) with a minimum grade of C or PHTH 1260 (may be taken concurrently) with a minimum grade of C or PHTH 1261 (may be taken concurrently) with a minimum grade of C or PHTH 1270 (may be taken concurrently) with a minimum grade of C or PSYC 1101 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Natural/Designed World

**INMI 3189. Research Methods in Communities of Color. (4 Hours)**

Aims to equip students with the skills for social research in intersectional issues of race and ethnicity. Examines how to carry out research with communities, engage with ethical considerations, and interrogate the historical and contemporary impact of research on communities of color. Familiarizes students with methodologies developed by oppressed communities that challenge the racialized and gendered inequalities underlying the production and dissemination of knowledge. Enables students to draw on insights from Ethnic Studies, Critical Health Studies, Disability Studies, and Women's Studies to examine the intersections between race, nation, gender, sexuality and (dis)ability. Teaches students how to utilize interviews, focus groups, participant observation, and arts-based methods in the context of community-based, anti-oppressive research. Offers students the opportunity to design a senior thesis research project.

**Attribute(s):** NUpath Analyzing/Using Data

**INMI 3461. Quantitative Conservation Biology. (4 Hours)**

Explores the foundational principles of the interdisciplinary field of conservation biology. Focuses on population biology, population genetics, community ecology, biogeography, and animal behavior. Relies on quantitative tools to answer important questions about species persistence in a rapidly changing world. Emphasizes developing and critiquing conservation solutions based on ecology, biology, genetics, and behavior, as well as recognizing differing perspectives and values.

**Prerequisite(s):** EEMB 1101 with a minimum grade of C- or EEMB 2302 with a minimum grade of C- or EEMB 2400 with a minimum grade of C- or ENVR 1101 with a minimum grade of C-

**Attribute(s):** NUpath Natural/Designed World

**INMI 3650. Plant Ecology. (4 Hours)**

Explores plant form and function, diversity and distribution, abundance and population dynamics, and interactions with individuals of the same or different species, as well their role in ecosystem processes. Views material through an evolutionary lens and at multiple levels of biological organization.

**Prerequisite(s):** EEMB 1101 with a minimum grade of C- or EEMB 2302 with a minimum grade of C- or EEMB 2400 (may be taken concurrently) with a minimum grade of C- or ENVR 1101 with a minimum grade of C-

**Corequisite(s):** INMI 3651

**Attribute(s):** NUpath Natural/Designed World

**INMI 3651. Lab for INMI 3650. (1 Hour)**

Accompanies INMI 3650. Includes various lab experiments that emphasize evolutionary and ecological principles, experimental design, and use and interpretation of statistics.

**Corequisite(s):** INMI 3650

**Attribute(s):** NUpath Natural/Designed World

**INMI 3654. Fire Ecology. (4 Hours)**

Introduces students to the ecology of fire, one of the most common and important disturbance events in terrestrial ecosystems. Examines how fire affects individual plants and animals (e.g., physiology, growth, reproduction, etc.), populations, ecological communities, ecosystem processes (e.g., nutrient and hydrologic cycling), and how the interplay between the abiotic and biotic worlds shape fire regimes. Explores how humans interact with fire, including European-American fire suppression and indigenous use of fire. Discusses how (prescribed) fire is used in restoration and ecosystem management and how climate change alters our ability to use this tool.

**Prerequisite(s):** EEMB 2302 with a minimum grade of D- or EEMB 2400 with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World

**Interdisciplinary Studies - Office of the Provost (INPR)****INPR 1000. First-Year Interdisciplinary Seminar. (1 Hour)**

Offers students an opportunity to advance their understanding of global citizenship, explore and meaningfully connect to the robust resources and programs of the university network, and apply design and systems thinking practices to address personal and academic challenges. Utilizes a global challenge as context and has both synchronous and asynchronous components led by faculty, peer mentors, academic advisers, and integration coaches.

**INPR 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INPR 2183. Interdisciplinary Special Topics: Pop-up Course. (1,2 Hours)**

Addresses timely trends, issues, and events as they unfold. Offers students an opportunity to learn about and respond to issues of the day in an immersive, interdisciplinary, short-course format. Content and instructors vary by offering. May be repeated three times for a maximum of six semester hours.

**INPR 2255. Experiential Entrepreneurship. (4 Hours)**

Examines the fundamental principles of experiential entrepreneurship and how those principles are used to identify unfulfilled market or societal needs, to solve social problems, and to innovate in public institutions. Offers students an opportunity to learn how to explore the context surrounding the need or problem; employ concepts of design thinking; examine various stakeholder groups (e.g., customers, constituents, potential partners, or beneficiaries); determine the size of the opportunity or problem; understand the landscape and intersectionality with other problems and stakeholders; and create a compelling value proposition, solution, or policy change that has the potential to capitalize on the unfulfilled need or solve the problem. Also guides students to reflect on why innovative and entrepreneurial endeavors often fail.

**Attribute(s):** NUpath Creative Express/Innov

**INPR 2955. Interdisciplinary Project. (1-4 Hours)**

Offers students an opportunity to work in an applied, interdisciplinary project setting on a research project, community or regional initiative, or industry-based solution. Students collaborate to define and refine the problem to be addressed, work toward one or more solutions, develop recommendations that are shared with a partnering project sponsor, and create a plan for implementation. An interdisciplinary team-based approach allows students to contribute their unique perspectives from multiple disciplines toward complex problems facing researchers, communities, and businesses. Offered on multiple Northeastern campuses as part of a semester-long program.

**INPR 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INPR 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INPR 4100. Research-Visiting Student. (0 Hours)**

Offers visiting students enrolled and in good standing at another institution an opportunity to work with a sponsoring faculty member on a topic related to current research. Detail of visit is described in the sponsoring faculty member's proposal approved prior to visit. Faculty member and student negotiate a written agreement as to what topic(s) are covered and what written or laboratory work forms the basis for the grade.

**INPR 4955. Interdisciplinary Project. (1-4 Hours)**

Offers students an opportunity to work in an applied, interdisciplinary project setting on a research project, community or regional initiative, or industry-based solution. Students collaborate to define and refine the problem to be addressed, work toward one or more solutions, develop recommendations that are shared with a partnering project sponsor, and create a plan for implementation. An interdisciplinary team-based approach allows students to contribute their unique perspectives from multiple disciplines toward complex problems facing researchers, communities, and businesses. Offered on multiple Northeastern campuses as part of a semester-long program.

**INPR 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INPR 5100. Foundations of Evidence-based Postsecondary Teaching. (4 Hours)**

Explores evidence-based teaching practices through the backward design process to offer students an opportunity to learn how to develop a college-level course. Includes building a generative toolkit that can be used to design college-level courses and other learning experiences. Uses a microteaching session to gain practice and feedback on the student's teaching.

**INPR 5110. Integrating Teaching Across Contexts. (4 Hours)**

Offers students an opportunity to identify a specific future context in which they anticipate teaching (e.g., clinical rotation, industry research group, K–12 outreach). Connects students with educators to explore related educational research on a chosen context and discipline-specific practices. Documents the teaching experience while students practice and receive feedback on their teaching in a microteaching session designed for this context.

**INPR 5120. Postsecondary Teaching Practicum. (4 Hours)**

Engages students in a teaching role sponsored by the university (e.g., teaching assistant, instructor of record for a course, undergraduate supervisor in a research lab). As part of a mentored teaching experience, offers students an opportunity to apply principles of evidence-based teaching and gather formative and summative student feedback on their teaching.

**Prerequisite(s):** INPR 5110 with a minimum grade of C

**INPR 5201. Applied AI Foundations: Practical Skills for Responsible Use. (1 Hour)**

Introduces practical AI use with a hands-on focus on responsible and effective tool engagement. Learners explore real-world applications through brief exercises, tool demonstrations, and focused case examples. Emphasizes human-centered design principles, ethical considerations, and foundational skills for evaluating when and how to use AI technologies in academic and professional settings.

**INPR 5900. Global and Intercultural Communication for Doctoral Students. (2 Hours)**

Focuses on the latest theories of global and intercultural communication and how they apply to doctoral research. Critically analyzes how concepts such as culture, power, privilege, and globalization arise in global research contexts. Designed to guide students to analyze their own identity and its role in framing their lived experiences as well as practice global and intercultural communication. Instruction and assessment include student reflections, writing assignments, a research-based project, and a self-assessment tool.

**INPR 6100. Research-Visiting Student. (0 Hours)**

Offers visiting students enrolled and in good standing at another institution an opportunity to work with a sponsoring faculty member on a topic related to current research. Detail of visit is described in the sponsoring faculty member's proposal approved prior to visit. Faculty member and student negotiate a written agreement as to what topic(s) are covered and what written or laboratory work forms the basis for the grade.

**INPR 6200. Global Research Literacies. (2 Hours)**

Offers students an opportunity, under the supervision of a faculty member, to investigate special-interest topics at a location other than the student's home campus. The topics, learning outcomes, assessments, course materials, course activities, and assessments are selected by the instructor. May be repeated up to three times for a maximum of 8 semester hours.

**INPR 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INPR 7900. Global Research Experience. (2 Hours)**

Offers students an opportunity, under the supervision of a faculty member, to learn skills and methods for conducting full-time research at a location other than the student's home campus. Faculty member and student negotiate a written agreement outlining which topic(s) are covered and what type of written or laboratory work forms the basis for the grade. May be repeated up to three times for a maximum of 8 semester hours.

**INPR 7970. Global Research Integration. (2 Hours)**

Offers students an opportunity to reexamine concepts—such as culture, power, privilege, globalization, and intercultural communication—and to reflect on awareness and insights derived from their experiences conducting global doctoral research abroad. Culminates in a final project (written work or a presentation) separate from their doctoral dissertation.

**INPR 7995. Global Experiential Project. (2 Hours)**

Offers students an opportunity to apply their curricular learning at a location other than the student's home campus. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. May be repeated up to three times for a maximum of 8 semester hours.

**INPR 8960. Exam Preparation - Doctoral. (0 Hours)**

Offers students an opportunity to prepare for the PhD qualifying exam under faculty supervision. May be repeated three times.

**INPR 8986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**INPR 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the program requirements for PhD candidacy.

**INPR 9100. Research-Visiting Student. (0 Hours)**

Offers visiting students enrolled and in good standing at another institution an opportunity to work with a sponsoring faculty member on a topic related to current research. Detail of visit is described in the sponsoring faculty member's proposal approved prior to visit. Faculty member and student negotiate a written agreement as to what topic(s) are covered and what written or laboratory work forms the basis for the grade.

**INPR 9990. Dissertation Term 1. (0 Hours)**

Offers dissertation supervision with the agreement of a thesis supervisor.

**Prerequisite(s):** INPR 9000 with a minimum grade of S

**INPR 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** INPR 9990 with a minimum grade of S

**INPR 9996. Dissertation Continuation. (0 Hours)**

Offers continuing dissertation supervision under individual faculty supervision.

**Prerequisite(s):** INPR 9991 with a minimum grade of S

## Interdisciplinary Studies in Science (INSC)

**INSC 1000. Science at Northeastern. (1 Hour)**

Introduces first-year students with majors in the College of Science to the liberal arts in general. Offers students an opportunity to become familiar with their college and majors; to develop the academic skills necessary to succeed (analytical ability and critical thinking); to become grounded in the culture and values of the University community; and to develop interpersonal skills—in short, presents students with the skills needed to become a successful university student.

**INSC 1200. First-Year Research Project. (1 Hour)**

Offers an opportunity for students to engage in supervised, project-based, group research.

**INSC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INSC 2963. Topics. (1,2 Hours)**

Offers undergraduate students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering. May be repeated three times.

**INSC 2964. Experiential Project. (0 Hours)**

Offers students an applied project setting in which to apply their curricular learning. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review 'lessons learned', and incorporate suggestions from this review to improve and further develop their career development and professional plan.

**INSC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INSC 2992. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**INSC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INSC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INSC 4998. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**INSC 5963. Topics. (1,2 Hours)**

Offers students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering. May be repeated three times.

**INSC 5964. Projects for Professionals. (0 Hours)**

Offers students an applied project setting in which to apply their curricular learning. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review "lessons learned", and incorporate suggestions from this review to improve and further develop their career development and professional plan.

**INSC 5965. Engaging with Industry Partners for Rising Professionals. (0 Hours)**

Offers students an enhanced applied project setting in which to apply their curricular learning. Working with a partner sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with the partner sponsor, and create a plan for implementing their recommendations. Curriculum supports students as they develop key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review lessons learned, and incorporate suggestions to improve and further hone their career development and professional plan. Career development opportunities through skill-building workshops, panels, and interview preparation are available. Partner-student interactions, including a culminating project presentation, allow partners to assess student potential for co-op, internship, or other employment opportunities with the partner.

**INSC 7100. Biophysics Seminar. (0 Hours)**

Provides a valuable platform for students to engage with a broad range of topics critical to their development as researchers and professionals in biophysics. Covers research ethics, student work-in-progress presentations, and faculty-led introductions to biophysics research. Features guest lectures from external biophysics researchers, offering students exposure to cutting-edge developments in the field. Also focuses on career development, including grant writing, publishing, and building a scientific career in academia or industry. Offers students the opportunity to expand their knowledge beyond their own research focus, foster collaboration with peers and faculty, and strengthen their professional networks.

## Interdisciplinary Studies in Social Sciences and Humanities (INSH)

### INSH 1000. Social Sciences and Humanities at Northeastern. (1 Hour)

Intended for freshmen in the College of Social Sciences and Humanities. Introduces freshmen to the liberal arts in general. Offers students an opportunity to become familiar with their major, to develop the academic skills necessary to succeed (analytical ability and critical thinking), to become grounded in the culture and values of the university community, and to develop interpersonal skills—in short, to become familiar with all the skills needed to become a successful university student.

### INSH 1102. Food in Contemporary Context. (4 Hours)

Offers a multidisciplinary set of perspectives on an intrinsic part of daily life—food. Food is not just about survival—it is about being human. Producing it, making it, eating it, obsessing about it is woven throughout our lives. It defines, and is defined by, culture. It is the basis of economies, has produced great fortunes, defines entire communities, and is the cause of conflicts. It is at once natural and artificial, grown and manufactured. It nourishes us and makes us sick. It is the source of sublime pleasure and no small anxiety. Food defines us, as much as we define it. With these considerations, this course uses food as a lens into contemporary life.

**Attribute(s):** NUpath Societies/Institutions

### INSH 1300. Introduction to Health and Humanities. (4 Hours)

Explores the ways in which narrative and other forms of creative and cultural expression help shape conceptions of illness, healing, and the body. Offers students opportunities to consider the health and humanities through a variety of interdisciplinary perspectives and genres. Includes small-group and classwide experiential field outings. Culminates in the composition of reflective responses, a medical ethics/medical journalism piece, and a team-based experiential e-portfolio project. Course objectives include differentiating between healing and curing; knowing how to elicit, listen to, and analyze stories to determine how participants in the healthcare system experience illness and healing; being able to articulate the ways health is a cultural construct; and using this analysis to identify an empathic response as a future professional.

**Attribute(s):** NUpath Interpreting Culture

### INSH 1600. Cultures of London - Abroad. (4 Hours)

Offers students in London an opportunity to learn about and interact with visual art and architecture and literary representations of the city. Examines how different peoples and different art forms have helped to shape the culture of this multicultural city over a span of some 400 years (from the Renaissance to contemporary London). Students read poetry, prose, and drama; attend theatrical events; and explore the city through walking tours and visits to historic sites. Seeks to develop familiarity with the critical, historical, and theoretical tools necessary to understand how imperial and colonial histories have shaped the cultures of London and the experiences of its citizens of diverse races, ethnicities, and regional or national identities.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

### INSH 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### INSH 2101. Love and Hate: Social, Psychological, and Literary Approaches. (4 Hours)

Studies materials that define and describe love and hate from the fields of literature and literary criticism, social psychology, and criminology and criminal justice. "Love" and "hate" are small words describing powerful emotions with profound effects on individuals and on social groups. Focusing largely on contemporary examples, offers students an opportunity to analyze the differences and areas of overlap in the above fields' approaches to love and hate, to discuss societal responses to these emotions, and to apply the methodologies of each field to research questions of their own. INSH 2101 and PSYC 2101 are cross-listed.

**Prerequisite(s):** ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**INSH 2102. Bostonography: The City through Data, Texts, Maps, and Networks. (4 Hours)**

Uses Boston as a case study for integrating computational methods with the social sciences and humanities to provide new insights into major cultural, historical, and societal questions as they relate to and extend beyond the city of Boston. Through lectures, discussions, and labs, the course examines a variety of data sets that measure geographic, historical, literary, political, civic, and institutional landscapes. Offers students an opportunity to combine analytical tools, such as geospatial mapping, data visualization, and network science, with readings, hands-on class activities, and museum or site visits, enabling a comprehensive view of complex cultural and social phenomena.

**Prerequisite(s):** CS 2500 (may be taken concurrently) with a minimum grade of D- or (DS 2000 (may be taken concurrently) with a minimum grade of D- ; DS 2001 (may be taken concurrently) with a minimum grade of D- )

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**INSH 2300. Culture, Technology, and the Future of Health. (4 Hours)**

Introduces the challenges posed by the data-heavy medicine of the future to privacy, the appropriate collection of medical data, and the ways that patients and healthcare workers alike think about health. Offers students an opportunity to learn how to use critical and ethical theories, analyze health narratives, and use historical and contemporary data about health disparities to forecast how new technologies might pose social and cultural challenges. Takes a humanities perspective to critically evaluate social and cultural aspects of a healthcare system shaped by emerging technologies and the data they produce.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**INSH 2963. Topics. (1,2 Hours)**

Offers undergraduate students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering. May be repeated three times.

**INSH 2964. Experiential Project. (0 Hours)**

Offers students an applied project setting in which to apply their curricular learning. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review 'lessons learned', and incorporate suggestions from this review to improve and further develop their career development and professional plan.

**INSH 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INSH 2992. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**INSH 3101. Research Methods in the Social Sciences. (4 Hours)**

Introduces the basic concepts involved in conducting research in the social sciences. Familiarizes students with the scientific methods that are necessary for systematic analysis of social behavior, societal trends, program effectiveness, and public attitudes through readings, lectures, group discussions, and research assignments. Offers students an opportunity to learn how to formulate a research question, investigate and critique how questions are researched, develop a research design, and obtain the critical thinking skills necessary to consume interdisciplinary research across the social sciences.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Writing Intensive

**INSH 3102. Introduction to Statistics in the Social Sciences. (4 Hours)**

Presents a foundation in different statistical techniques that may be utilized to answer research questions in the social sciences. Examines a range of computational social science techniques across data platforms to address societal problems. Emphasizes existing databases that may inform questions in the social sciences. Also introduces students to different ways to display or visualize quantitative data. Offers students an opportunity to learn how to produce and consume quantitative information.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**INSH 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INSH 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INSH 4998. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**INSH 5183. Interdisciplinary Special Topics: Pop-up Course. (1,2 Hours)**

Addresses timely trends, issues, and events as they unfold. Offers students an opportunity to learn about and respond to issues of the day in an immersive, interdisciplinary, short-course format. Content and instructors vary by offering. May be repeated three times for a maximum of six semester hours.

**INSH 5301. Introduction to Computational Statistics. (4 Hours)**

Introduces the fundamental techniques of quantitative data analysis, ranging from foundational skills—such as data description and visualization, probability, and statistics—to the workhorse of data analysis and regression, to more advanced topics—such as machine learning and networks. Emphasizes real-world data and applications using the R statistical computing language. Analyzing and understanding complex data has become an essential component of numerous fields: business and economics, health and medicine, marketing, public policy, computer science, engineering, and many more. Offers students an opportunity to finish the course ready to apply a wide variety of analytic methods to data problems, present their results to nonexperts, and progress to more advanced course work delving into the many topics introduced here.

**INSH 5302. Information Design and Visual Analytics. (4 Hours)**

Introduces the systematic use of visualization techniques for supporting the discovery of new information as well as the effective presentation of known facts. Based on principles from art, graphic design, perceptual psychology, and rhetoric, offers students an opportunity to learn how to successfully choose appropriate visual languages for representing various kinds of data to support insights relevant to the user's goals. Covers visual data mining techniques and algorithms for supporting the knowledge-discovery process; principles of visual perception and color theory for revealing patterns in data, semiotics, and the epistemology of visual representation; narrative strategies for communicating and presenting information and evidence; and the critical evaluation and critique of data visualizations. Requires proficiency in R.

**INSH 5304. Social Network Analysis. (4 Hours)**

Offers an overview of the analytic methods and conceptual perspectives of a social network approach to social science and humanities research. Using the R statistical computing language, covers techniques for collecting, formatting, and visualizing network data, as well as tools for calculating the mathematical properties of social networks, such as centrality, clustering, transitivity, and structural equivalence. Introduces statistical methods for social network analysis, such as exponential random graph models and stochastic actor-oriented models.

**INSH 5602. Archives and Ethnography. (4 Hours)**

Examines the ethics, politics, and social aspects of three primary areas of interdisciplinary research and knowledge production at the intersection of the social sciences and humanities: oral history, ethnography, and archiving. Offers students an opportunity to learn to conduct oral history, ethnography, and archiving; gain experience collecting and formatting information collected through these qualitative techniques; and be introduced to digital platforms for oral history, ethnography, and archiving. Offers instruction in critiquing examples of how researchers collect and analyze qualitative information. Studies the critical thinking skills necessary to build a research project from the formulation of a research idea through the research design planning process.

**INSH 5603. Qualitative Methods. (4 Hours)**

Introduces the principles and use of common qualitative methods with a particular focus on their application in the social sciences. Students practice designing qualitative research. Offers students an opportunity to gain experience using diverse analytic and theory building techniques, conducting field observations and interviews, and analyzing content. Examines the foundation of core concepts in research. Topics include objectivity, bias, empiricism, validity, triangulation, and ethical issues surrounding human subjects—such as confidentiality, anonymity, and vulnerable populations.

**INSH 5963. Topics. (1,2 Hours)**

Offers students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering. May be repeated three times.

**INSH 5964. Projects for Professionals. (0 Hours)**

Offers students an applied project setting in which to apply their curricular learning. Working with a sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with a partner sponsor, and create a plan for implementing their recommendations. Seeks to benefit students with a curriculum that supports the development of key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review 'lessons learned,' and incorporate suggestions from this review to improve and further develop their career development and professional plan.

**INSH 5965. Engaging with Industry Partners for Rising Professionals. (0 Hours)**

Offers students an enhanced applied project setting in which to apply their curricular learning. Working with a partner sponsor, students refine an applied research topic, perform research, develop recommendations that are shared with the partner sponsor, and create a plan for implementing their recommendations. Curriculum supports students as they develop key business communication skills, project and client management skills, and frameworks for business analysis. Offers students an opportunity to learn from sponsor feedback, review lessons learned, and incorporate suggestions to improve and further hone their career development and professional plan. Career development opportunities through skill-building workshops, panels, and interview preparation are available. Partner-student interactions, including a culminating project presentation, allow partners to assess student potential for co-op, internship, or other employment opportunities with the partner.

**INSH 6101. Agent-Based Modeling for Applied and Social Sciences. (4 Hours)**

Introduces complexity-based models, most notably agent-based models, and their possible applications to a range of planning and public policy issues. Exposes students to complexity theory and methods, including interactions, adaptation, and evolution; cellular automata, agents, networks, and genetic algorithms; and epistemology—the meaning and applications of models. Focuses on modeling and software, including building on sample models; running experiments and analyzing results; and verification, sensitivity, and validation.

**INSH 6300. Research Methods in the Social Sciences. (4 Hours)**

Surveys methods of social research, including field study and participant observation techniques, survey techniques, interviewing and questionnaire construction, sampling procedures, experimental design, content analysis, and use of available data.

**INSH 6302. Qualitative Methods. (4 Hours)**

Introduces the principles and use of common qualitative methods with a particular focus on their application in the social sciences. Offers students an opportunity to engage in primary data collection and to learn how to use a variety of analytic techniques, including transcription, field-note preparation, memos, development of coding schemes and conceptual frameworks, and data-verifying techniques.

**INSH 6304. Modeling and Analyzing Social Networks. (4 Hours)**

Offers a high-level introduction to the analytic methods and conceptual perspectives of a social network approach. Introduces the social network perspective and computational tools for social network analysis (R, RStudio, and Gephi). Identifies the mathematical properties of social networks, including centrality, clustering, transitivity, and structural equivalence. Introduces exponential random graph models and stochastic actor-oriented models. Using these tools, studies social and cultural phenomena across the social sciences and humanities.

**INSH 6406. Analyzing Complex Digitized Data. (4 Hours)**

Introduces cutting-edge ways of structuring and analyzing complex data or digitized text-as-data using the open-source programming language Python. Scholars across multiple disciplines are finding themselves face-to-face with massive amounts of digitized data. In the humanities and social sciences, these data are often in the form of unstructured text and un- or under-structured data. Encourages students to think about novel ways they can apply these techniques to their own data and research questions and to apply the methods in their own research, whether it be in academia or in industry.

**INSH 6500. Statistical Analysis. (4 Hours)**

Studies the use of social science quantitative techniques, emphasizing applications of value to public-sector analysts and scholars alike. Introduces probability and statistical analysis. Topics include measures of central tendency and dispersion, probability and probability distributions, sampling distributions and hypothesis testing, bivariate correlation, regression, and forecasting. Examines how to generate and interpret statistical analyses.

**INSH 6864. Experiential Integration. (1 Hour)**

Offers an integration course providing an opportunity for students on experiential placement to connect conceptual course material to experiential components. Students are expected to: interact with students from other disciplines, apply knowledge and skills across educational and experiential contexts; connect experiential components to different disciplines and domains of knowledge; and situate experiential components in the context of their own field and beyond. Requires department signature. May be repeated once.

**Prerequisite(s):** CRIM 6964 (may be taken concurrently) with a minimum grade of S or CRIM 6965 (may be taken concurrently) with a minimum grade of S or ECON 6964 (may be taken concurrently) with a minimum grade of S or ECON 6965 (may be taken concurrently) with a minimum grade of S or ENGL 6964 (may be taken concurrently) with a minimum grade of S or POLS 6964 (may be taken concurrently) with a minimum grade of S or PPUA 6964 (may be taken concurrently) with a minimum grade of S or PPUA 6965 (may be taken concurrently) with a minimum grade of S

**INSH 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for a co-op work experience. May be repeated twice.

**INSH 7101. Qualitative Research Design. (4 Hours)**

Introduces the logic of qualitative inquiry and various qualitative data collection strategies including field observation, in-depth interviews, focus groups, and archival materials. Suitable for students in a range of social scientific disciplines including anthropology, sociology, political science, public policy, criminal justice, population health, nursing, and applied psychology. Offers students an opportunity to obtain a foundation for essential aspects of research design as well as hands-on experience in data collection techniques around a topic of the student's choosing.

**INSH 7102. Qualitative Data Analysis. (4 Hours)**

The goal of this course is to introduce students to methods for analyzing different forms of qualitative data. The course will train students in developing coding strategies to analyze qualitative data and introduces them to qualitative data software. Students will learn how to apply deductive and inductive coding, how to develop coding structures appropriate for various genres (e.g., exploratory, descriptive, narrative), and how to theorize from qualitative data. Students will receive extensive training in writing up qualitative research findings, from analytic memos to a publishable paper or dissertation chapter.

**Prerequisite(s):** INSH 5603 with a minimum grade of C or INSH 7101 with a minimum grade of C

**INSH 7103. Mixed Methods Research. (4 Hours)**

Introduces the theory and practice of mixed method inquiry in the social sciences, broadly defined. Presents an overview of historical roots of mixed methods research, the major paradigms driving contemporary mixed methods research, and the four most common research designs applied in mixed methods research (concurrent, sequential, embedded, and multiphase). Studies how to evaluate the validity and quality of mixed methods research. Offers students an opportunity to develop a research protocol for a mixed methods research project.

**INSH 7300. Advanced Research Methods in the Social Sciences and Humanities. (4 Hours)**

Provides instruction in all aspects of research methodology in the social sciences and humanities, including causality; the measurement process; sampling procedures; scaling; use of available data; research designs, such as quantitative and qualitative survey methods, experimental design, and evaluation research; and methodological complexities such as mediation, moderation, and nonlinear processes.

**INSH 7400. Quantitative Analysis. (4 Hours)**

Studies the use of social science quantitative techniques and how to generate and interpret statistical analyses. Topics include measures of central tendency and dispersion, probability and probability distributions, sampling distributions and hypothesis testing, bivariate correlation, regression, and forecasting. Builds upon the concepts of correlation and inference to present analytic procedures involving several variables (including multiple regression, logistic regression, causal analysis, and multiway ANOVA) and introduces more advanced multivariate analytic methods.

**Prerequisite(s):** INSH 5301 with a minimum grade of C or INSH 6500 with a minimum grade of C

**INSH 7500. Advanced Quantitative Analysis. (4 Hours)**

Designed to build upon the foundations provided by INSH 6404, INSH 6500, or an equivalent introductory statistics course with the goal of students becoming proficient with selected quantitative multivariate analysis techniques. Covers the ordinary least squares (OLS) regression model and the assumptions underlying it in detail, as well as the techniques for analyzing data when OLS assumptions do not apply, such as simultaneous equation models, time-series models, and maximum likelihood techniques for limited and discrete dependent variables. Requires prior completion of INSH 6404, INSH 6500, or an equivalent introductory statistics course. PhD students only or by permission.

**Prerequisite(s):** INSH 7400 with a minimum grade of C

**INSH 7600. Multilevel Theorizing and Analysis. (4 Hours)**

Explores advanced data analysis tools for research. Offers students an opportunity to engage in multilevel theorizing and to become proficient in the foundations of multilevel analysis. The course is project based; students formulate a multilevel research question and engage multilevel theory, data, and analysis.

**INSH 7910. NULab Project Seminar. (2 Hours)**

Offers students an opportunity to learn and use digital humanities methods with others in groups and across disciplines in the collaborative space of the NULab seminar. May be repeated up to three times.

**INSH 9980. Experiential PhD Research Residency. (0 Hours)**

Comprises a research residency experience in an organization whose mission and activities are aligned with the College of Social Sciences and Humanities PhD programs. The research residency is designed to help develop dissertation ideas or research papers or to obtain access to resources helpful to dissertation development or research. A faculty member serves as an advisor for the residency experience, but individuals within the organization in which the student is working are asked to serve as formal mentors for the student residency experience. May be repeated two times.

**International Affairs (INTL)****INTL 1000. International Affairs at Northeastern. (1 Hour)**

Introduces first-year international affairs students to the majors, the departments servicing IAF, and the university as a whole; familiarizes students with the skills needed for success as a university student.

**INTL 1101. Globalization and International Affairs. (4 Hours)**

Offers an interdisciplinary approach to analyzing global/international affairs. Examines the politics, economics, culture, and history of current international issues through lectures, guest lectures, film, case studies, and readings across the disciplines.

**Attribute(s):** NUpath Societies/Institutions

**INTL 1150. The Mediterranean World: An Overview. (4 Hours)**

Introduces problems currently facing the nations of the Mediterranean region, the sources of these problems, how they are affecting the rest of the world, and what the future of the region may be. The Mediterranean is a region of significant international geopolitical importance where three major religions and continents meet, very different demographic patterns interact, the challenge of adapting to global economic and social forces is being faced, and security and terrorism are major problems. Surveys the Mediterranean region, its characteristics and significance, the changes it has experienced, and the ways in which societies around the Mediterranean currently interact and influence each other.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**INTL 1160. Middle East Studies. (4 Hours)**

Concentrates on the history, politics, cultures, and economics of the Middle East and North Africa (MENA) countries in the 20th and 21st centuries. Explores topics such as empire, colonialism, revolutions, state-building, development, and social movements. Offers students an opportunity to obtain interdisciplinary skills to analyze dynamics of gender, class, race/ethnicity, and religion in MENA countries.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**INTL 1251. Dante's "Inferno" and Medieval Italian Culture. (4 Hours)**

Presents an overview of Dante's "Commedia," with a focus on the first book, "Inferno." Explores the descending levels of hell, analyzing the historical and cultural context of Dante's time, including political events and social structures. Examines theological concepts such as sin, punishment, redemption, and the afterlife from the perspective of Christian theology. Through the literary analysis of selected chapters (canti), evaluates the potential relevance of the poem to the modern human condition and to the reader's own experiences. Taught in English.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Interpreting Culture

**INTL 1973. Special Topics in Italian Culture. (4 Hours)**

Presents an in-depth exploration of aspects of Italian cultural, social, and intellectual history, which could include literature, philosophy, art, education, politics, gender, and society. Emphasizes critical analysis of primary and secondary sources, historical context, and interdisciplinary perspectives to deepen students' understanding of Italy's rich heritage and its place within global intellectual discourse. Themes and topics vary. Taught in English. May be repeated twice.

**INTL 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INTL 2100. Modern Israel. (4 Hours)**

Examines Israeli politics and Israel's diverse cultures. Emphasizes the rich cultural fabric of Israeli society, the Israeli political system, the startup nation innovators, and some of the tensions and contradictions that lie at the heart of Israeli society. Covers the intersecting histories of Ashkenazi (European) and Sephardic and Mizrahi (North African and Middle Eastern) Jews; Christian, Muslim, and Druze citizens; Orthodox and secular populations; as well as of the immigrants from Russia and Ethiopia. Introduces the history of Zionism and Palestinian nationalism and touches on some aspects of the Arab-Israeli conflict.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**INTL 2101. Law and Religion in Israel. (4 Hours)**

Examines how religious diversity features into Israeli life, society, and laws. Israel maintains a unique form of legal pluralism in regulating its official religious communities and their courts. Considers how Israeli society, its religious and civil courts, and its government navigate the challenges that Israel faces as a self-defined "Jewish and democratic state" with a legal commitment to the religious autonomy of its officially recognized religious communities. Explores the complex interplay between religion and law in the daily life of Israel's citizens.

**INTL 2200. America and the Middle East. (4 Hours)**

Focuses on U.S. engagement with the Middle East, primarily with Muslim societies, and with the Christian and Jewish communities across the region. Emphasizes Egypt, Syria, Iran, Iraq, Turkey, Israel/Palestine, and Lebanon. From America's first proselytizing adventure to the Ottoman Empire in 1820 to the embrace of Saudi Arabia in the 1940s to the overthrow of the democratically elected prime minister in Iran in 1953 to the attacks of September 11, 2001, to the invasion and occupation of Iraq in 2003 to America's response to the "Arab Awakening" in 2011 and beyond, the course covers history, politics, oil, war, and peacemaking within the framework of U.S. involvement in the Middle East.

**Attribute(s):** NUpath Societies/Institutions

**INTL 2480. Women and World Politics. (4 Hours)**

Introduces a variety of issues facing women across the globe. Focuses on the gender dynamics of key issues in international affairs. These could include economic policy, conflict and war, human rights/women's rights, political power, and collective action. Draws on examples from various world regions since the twentieth century to analyze similarities and differences across cases around the globe. INTL 2480 and WMNS 2480 are cross-listed.

**Prerequisite(s):** INTL 1101 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**INTL 2500. Race and Global Human Mobility. (4 Hours)**

Examines the relationship between race and the movement of people around the globe. Offers students an opportunity to acquire a concrete understanding of how race and ethnicity (as social constructions) have developed as people have migrated (under free will or forced circumstances) within and across geopolitical territories (i.e., colonies, countries) in the past (1400s) and through the present. Ethnoracial-related conflicts connected to migration (i.e., rebellions by the enslaved during the Atlantic slave trade, Rwandan genocide, Syrian civil war) may also be explored.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**INTL 2600. Artificial Intelligence and World Politics. (4 Hours)**

Examines how the effects of artificial intelligence permeate all aspects of life and impact world politics. Explores the implications of AI uses and their impacts in different areas of international relations driven by profound transformations: great power rivalry, challenges posed to global cooperation, provision of humanitarian assistance, achieving the United Nations sustainable development goals, and using AI in the military and warfare. Introduces and assesses AI policies adopted by states and engages with AI's application at multiple societal levels, uncovering the ethical, moral, and international legal implications. Considers how technological developments are outpacing diplomatic negotiations, highlighting how global institutional changes can prevent unethical and unlawful uses as pathways to peace and security in the contemporary world order.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Ethical Reasoning

**INTL 2718. Research Methods in International Affairs. (4 Hours)**

Introduces a range of research methods employed in the study of international affairs. Offers students an opportunity to develop competency in the most commonly used quantitative and qualitative research tools in the social sciences and related humanities. Topics include empirical and normative research traditions, generalizability, historical analyses, hypothesis testing, literature reviews, qualitative and quantitative approaches, research ethics, survey research, units of analysis, and more.

**INTL 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INTL 3150. Global Philanthropy. (4 Hours)**

Analyzes whether transnational philanthropy can solve problems of global poverty, development, and human welfare. Introduces students to relevant normative and empirical scholarship drawn from moral philosophy, postcolonial critical theory, development economics, and comparative politics. Offers students an opportunity to obtain the analytical tools needed to assess the promise and pitfalls of global philanthropy. Invites the application of these skills through a sustained funding simulation.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**INTL 3200. Cities in a Global Context. (4 Hours)**

Examines the roots of the urbanization process, major ways of thinking about it, and the development of world cities and megacities. The twenty-first century will be a century in which urbanism is a central problem and opportunity. Considers the economic, political, cultural, and environmental dimensions of urbanism across the globe. Includes specific case studies from around the world. Encourages students to develop a knowledge of particular cities in order to examine the key themes of the course. INTL 3200, ANTH 3200, and SOCL 3200 are cross-listed.

**INTL 3201. Cities in a Global Context (Abroad). (4 Hours)**

Focuses on the character of space, place, and culture of a contemporary world (global) city. Explores the material transformations of the city and how people understand and imagine the places, spaces, times, and environments they inhabit. Addresses issues of global geographies of cultural change, especially the relationship between the local and the global; questions of place, identity, and landscape, especially at the local level; the significance of place and space in the invention of modern traditions, including places of memory (memorials, museums); the nature of public space and its relations to citizenship; gentrification and the role of art in the city and nature-society relations as expressed in urban parks. Includes a combination of lectures and guided and self-directed field trips in the selected global city. May be repeated without limit.

**INTL 3300. Covering Conflicts: Peace, War, and the Media. (4 Hours)**

Examines the media's portrayal of conflicts and the peace process in the Middle East, Northern Ireland, Bosnia, Rwanda, and elsewhere. Evaluates the limits of fairness, balance, and accuracy in the coverage. Looks at the U.S. and international media—print, broadcast, and online—and some of the major stories in recent years and attempts to put these stories in historical, political, and social context. Analyzes the wide-ranging criticism of coverage from a variety of perspectives. INTL 3300 and JRNL 3300 are cross-listed.

**INTL 3350. Borders and Racial Security. (4 Hours)**

Presents a comprehensive overview of governance of borders across the world. Addresses the disconnect and tension between the concept of a world without borders and the post-September 11 realities of increased border securitization. Explores the link between securitized borders and racism by unpacking the concept of racial security. Critically examines how borders are used to treat various groups and people differently, and introduces an intersectional analysis of race, ethnicity, gender, and class. Explores the geopolitics of securitized borders, border cities, and bordering practices beyond material border zones. Analyzes cross-border activities, transnational human rights activism, and freedom of mobility.

**INTL 3400. International Conflict and Negotiation. (4 Hours)**

Offers an interdisciplinary approach to analyzing international conflict and negotiations: how conflicts evolve, are managed, and/or resolved. In dealing with different types of regional and international conflicts, students focus on historical, ethnic, religious, geographic, and political aspects of a variety of conflicts and the consequences these conflicts hold for regional and international actors.

**Prerequisite(s):** INTL 1101 with a minimum grade of D- ; POLS 1160 with a minimum grade of D- ; (ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**INTL 3406. International Law. (4 Hours)**

Introduces international law and how it redefines and shapes world politics. Offers students an opportunity to learn about the cornerstones of this area of the law: the state, organizations and their legal personality, diplomatic relations, treaties, extraterritorial jurisdiction, extradition, human rights and humanitarian law, the law of the sea trade/economic law, and international criminal law with a focus on the world courts. Considers the degree to which international law is pervasive in the life of individuals and states alike.

**Prerequisite(s):** POLS 1160 with a minimum grade of D-

**INTL 3430. Revolution, Civil War, and Insurrection. (4 Hours)**

Explores various types of conflict settlements and their implications for peace and reconciliation. Why do civil wars break out in some places but not others? What does it take to start a revolution? Why do some conflicts last decades, and what can be done to mitigate their costs? Examines why civil conflicts begin, how they are fought, and how they end. Substantive topics include strategies of insurgency and counterinsurgency; the role of ethnicity, religion, and gender; and the relationship between economic factors and conflict. Students leverage fundamental concepts and theories in comparative politics to analyze civil conflicts in a wide range of country contexts.

**Prerequisite(s):** POLS 1160 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**INTL 3450. Security, Culture, Power. (4 Hours)**

Offers a critical and interdisciplinary approach to the study of security. Analyzes the politics, culture, geography, and history of security as a major force shaping the contemporary world. Aims to develop a critical analysis of how power operates in and through security by examining questions of how security shapes cities, states, space, and society from the cultural and psychological terrain of fear to the international terrain of war, capitalism, migration, and transnational conflicts.

**Prerequisite(s):** INTL 1101 with a minimum grade of D- ; POLS 1160 with a minimum grade of D- ; (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Societies/Institutions

**INTL 3455. Russian Foreign Policy. (4 Hours)**

Presents an analysis of the goals, methods, and achievements of Russian policy in the post-Soviet era toward Eastern Europe, Western Europe, the Middle East, Central and East Asia, and the United States against the background of Soviet behavior toward these areas in the recent past.

**Prerequisite(s):** POLS 1155 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**INTL 3470. Arab-Israeli Conflict. (4 Hours)**

Explores the history and politics of the Arab-Israeli conflict, examining the origins of the conflict, its development over time, the key events that have shaped it, and the different narratives and perceptions of these events. Offers students an opportunity to learn about the conflict from the emergence of Zionism and Arab nationalism up to present day. Emphasizes the Israeli-Palestinian dimension of the conflict.

**Prerequisite(s):** ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity

**INTL 3520. Global Political Economy. (4 Hours)**

Examines how states, institutions, policy choices, and social forces shape—and are influenced by—the global economy and the world polity. Draws on historical patterns and empirical evidence of societal behavior to evaluate the evolution of global development policy over time and across space. Uses country illustrations and case studies to demonstrate how examining development policy trade-offs can provide guidance for formulating sustainable development policies at the global level. Focuses on global governance and how decisions about global rules related to industrial policy, foreign investment policy, and climate change policy are made at the level of several international institutions.

**Attribute(s):** NUpath Societies/Institutions

**INTL 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INTL 4100. Forced Migration: Refugees, Exiles, and Displaced Persons. (4 Hours)**

Analyzes the history and politics of forced migration, concentrating on the negative "push" factors that force people to migrate and the positive "pull" factors that motivate them to seek sanctuary in particular places. While millions of people worldwide are displaced by war and other forms of violence, the history of forced migration and processes of seeking and granting refuge are often poorly understood. Investigates the development of legal and institutional frameworks that govern forced migration and assesses its political and humanitarian implications. Rejecting dominant views of displaced people as "victims" or as "problems" to "solve," the course addresses displaced people as complex historical actors whose experiences are tied to legacies and processes of imperialism, state violence, war, and globalization.

**INTL 4350. Ethnography of Southeast Asia. (4 Hours)**

Offers a seminar on the societies and cultures of Southeast Asia. Uses an interdisciplinary approach to this diverse and dynamic geopolitical region, with readings from anthropology, history, political science, and literature. Covers the major political and cultural changes that have shaped Southeast Asia in relation to the world—from the age of colonial expansion, to the rise of nation-states, to the present global era. Examines central questions in the ethnography of Southeast Asia, emphasizing the postcolonial legacies of Southeast Asia, states and violence, culture and mobility, and pressing contemporary issues in globalizing Southeast Asia. ANTH 4350 and INTL 4350 are cross-listed.

**Prerequisite(s):** SOCL 1101 with a minimum grade of D- or ANTH 1101 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**INTL 4500. Latin American Society and Development. (4 Hours)**

Explores the processes of social, economic, and cultural change in Latin America. While concentrating on the present, traces class formation, agrarian structures, ethnic identity, ceremonial organization, gender roles, and political conflict since the colonial era in a range of countries. Emphasizes the relationship of communities and national political and economic systems. May emphasize Central America and Mexico or countries in South America through case studies. ANTH 4500 and INTL 4500 are cross-listed.

**Prerequisite(s):** (SOCL 1101 with a minimum grade of D- or ANTH 1101 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- ); (ENGL 1111 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**INTL 4510. Contemporary Issues in Global Africa. (4 Hours)**

Explores Africa's changing place in the world. Studies the history of Africa and explores the role of ethnography in the making of colonial Africa and the cultural transformations and continuities produced by the emergence of African cities during and after colonialism. Studies postcolonial Africa to critically and comparatively engage with contemporary issues facing African societies. Considers the efflorescence of new cultural forms of music, art, film, and literature, in conjunction with new sources of identity such as nationality, religion, ethnicity, consumption, and migration.

**Prerequisite(s):** (ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- ); (ENGL 1102 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**INTL 4520. Chinese Society and Culture. (4 Hours)**

Introduces students to changes in society and economy in contemporary China. Examines changes in family, gender relations, rural life, work, and international relations. Draws on literature from a range of disciplines including sociology, political science, anthropology, and economics.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**INTL 4700. Senior Capstone Seminar in International Affairs. (4 Hours)**

Offers a senior research and writing seminar that integrates and assesses the knowledge and skills developed by students participating in the international affairs curriculum, including both experiential (co-op, Dialogue of Civilizations, study abroad, internship, or other approved international experience) and classroom-based components. Requires student self-reflection as well as new research, analysis, and writing, which culminate in a final paper and presentation. Topics include contemporary global issues and draw on relevant literature in the disciplines relating to international affairs.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**INTL 4938. Dialogue of Civilizations: Globalization and Social Sciences. (4 Hours)**

Engages students with the culture, civilization, and people of the countries studied and visited. The course provides students with an in-depth and on-site experience, learning the politics, sociology, journalism, human services, law, public policy, and/or economics and business in the country of study. Students connect with their peers in each country/society and gain a “global experience” that enhances their academic studies on campus in Boston. The experience culminates in an independent research project conducted by the students before, during, and after their time in-country. May be repeated without limit.

**INTL 4944. Dialogue of Civilizations: Regional Engagement. (4 Hours)**

Engages students with the cultures, societies, and peoples of particular countries and localities in one primary geographic region. Offers students an in-depth and on-site experience and an opportunity to learn about various aspects of the region, which may include politics, sociology, law, history, philosophy, culture, music, arts, literature, theatre, economics, and/or business. Students may connect with their peers in each locality and across societies, therein to gain an international experience designed to enhance their academic studies on campus in Boston. Culminating projects may include a research paper, an artistic expression piece (i.e., film or photos), or other assignment as determined by the professor. May be repeated without limit.

**INTL 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**INTL 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** INTL 4970 with a minimum grade of D-

**INTL 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INTL 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**INTL 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**INTL 4994. Internship. (1-4 Hours)**

Offers students an opportunity for internship work. May be repeated up to nine times for a maximum of 28 semester hours.

**Attribute(s):** NUpath Integration Experience

**INTL 5010. International Human Rights Law and Policy. (4 Hours)**

Examines the law, politics, policy, and advocacy practices of international human rights. Focuses on the dilemmas that ensue and the political, policy, and philosophical implications of human rights. Explores the role of international and domestic law in enacting and enforcing human rights claims, the institutions of international human rights law, and the relationships between different types of rights. Places human rights in the context of colonialism, racism, and economic inequality. Analyzes how and when human rights law and practice can adequately address global challenges as well as when they fall short.

**INTL 5100. Climate and Development. (4 Hours)**

Serves as an introduction to climate change and development processes in developing countries. Exposes students to key debates in the fields of climate change and international development. Offers students an opportunity to learn about the approaches to climate adaptation, the relationship between adaptation and development, and concepts of resilience and transformation. Using a comparative case study approach, explores the importance of the local context; the intersections of politics, economics, and culture; ecology and human-environment relationships; and the role (and challenges) of finance and development assistance. Climate impacts threaten to reverse many of the development gains of the last century, and the most vulnerable are likely to be the most impacted by climate change. At the same time, opportunities exist to ensure climate-compatible development pathways. Cross-listed with PPUA 5100.

**Attribute(s):** NUpath Societies/Institutions

**INTL 5268. International Environmental Policy. (4 Hours)**

Explores key environmental challenges and policy solutions from an international perspective. Emphasizes the complexity of human-natural systems for policy design, provides a history of international environmental politics, and discusses contemporary policy issues. Presents key paradigms for understanding environmental challenges and the analytical tools to look critically at important debates, understand the role of different actors, identify equity and justice considerations, and assess policy options from multiple perspectives. Focuses on global environmental governance and sustainable development diplomacy, natural resource management, and climate change policy. Addresses the role of science in policymaking, tensions between environment and development, the scale and complexity of international environmental governance, and equity and justice.

**INTL 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**INTL 7990. Thesis. (4 Hours)**

Offers thesis supervision by members of the department.

**INTL 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers continued thesis supervision by individual members of the program.

**International Business (INTB)****INTB 1203. International Business and Global Social Responsibility. (4 Hours)**

Introduces the student to forces and issues confronted in our era of rapid globalization. Managers must understand forces from interconnected social, political, and economic national environments that affect their company's operations. At the same time they need to draw on their ethical foundations to address and act on social responsibility imperatives across national borders.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Interpreting Culture

**INTB 1204. Living, Learning, and Leading Globally. (1 Hour)**

Functions as a foundational, cornerstone course that frames the Global Engagement Program and assists students in mapping their way forward. Covers cultural and ethical frameworks for understanding the context of global business as an integrated whole. Introduces global leadership competencies combined with multiple assessments to help foster greater self-awareness and establish a baseline for subsequent development. Offers students an opportunity to create a four-year professional development plan (PDP), a living document designed to guide students' study and development throughout the program and to cultivate the mindset necessary for effective and authentic global leadership. May be repeated two times.

**INTB 1205. The Global Business Environment. (4 Hours)**

Describes the economic, political, regulatory, legal, cultural, international financial system, and geographic distance differences in the international business environment. Discusses how it differs from domestic business contexts and emphasizes the importance of international business to global enterprises. Offers students an opportunity to learn ethical reasoning in international business contexts, government-business relations, as well as the role of national interests and their impact on international business. Studies regional integration (e.g., the European Union), and introduces the role of foreign direct investment. Surveys how international business contributes to economic development. Portrays the antiglobalization movement and the rise of protectionism, nationalism, and industrial policy.

**Attribute(s):** NUpath Ethical Reasoning

**INTB 1209. International Business and Global Social Responsibility. (4 Hours)**

Does not count as credit for business majors. Counts as INTB 1203 for business minors only.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Interpreting Culture

**INTB 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INTB 2205. Business Decision Making in Developed Country Environments. (2 Hours)**

Focuses on international business decisions in developed nations such as the European Union, Japan, and other OECD countries and the growing importance of e-commerce. Covers export/import operations, establishing overseas joint ventures and alliances, and analyzing foreign direct investment as a key choice. Discusses configuring global supply chains and establishing global manufacturing operations. Introduces international marketing and international human resource policies. Offers students an opportunity to learn about global teams and assessing international business performance.

**Prerequisite(s):** INTB 1203 with a minimum grade of D- or INTB 1205 with a minimum grade of D- or INTB 1209 with a minimum grade of D-

**Corequisite(s):** INTB 2206

**Attribute(s):** NUpath Writing Intensive

**INTB 2206. International Business Decision Making in Emerging Markets. (2 Hours)**

Discusses how emerging markets fit into the global economy. Presents unique issues such as lack of infrastructure, limited affordability, volatile economies, political risk, and poverty alleviation. Describes how trade and foreign exchange policies affect emerging markets. Focuses on which emerging markets to invest in, why, and what market-entry strategies to use. Emphasizes the business opportunity in serving the poor in emerging markets. Covers the rise of digital commerce in emerging markets. Offers students an opportunity to learn about the outlook for emerging markets and implications for developed countries and the global economy.

**Prerequisite(s):** INTB 1203 with a minimum grade of D- or INTB 1205 with a minimum grade of D- or INTB 1209 with a minimum grade of D-

**Corequisite(s):** INTB 2205

**Attribute(s):** NUpath Writing Intensive

**INTB 2501. Competing to Win in Emerging Markets. (4 Hours)**

Presents an introduction to emerging markets, focusing on the BRIC countries of Brazil, Russia, India, and China. Takes the perspective of U.S. companies and what they must do to be successful in emerging markets. Discusses the differences between doing business in an emerging vs. a domestic market, the opportunities and potential of an emerging market, and the risks of operating in such a market. Then looks at the world from the perspective of emerging markets and discusses steps that their governments, companies, and entrepreneurs must take to succeed in the world economy. Analyzes what emerging markets must do to raise wages and incomes, accelerate wealth creation, and reduce poverty.

**INTB 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INTB 3205. Understanding and Managing Cultural Differences. (4 Hours)**

Emphasizes the importance of cultural differences in international business. Describes the value of developing cultural agility in a global career, and discusses startups in diverse cultural contexts. Focuses on learning from international experiences and highlights the science behind what makes people successful in different countries and with people from different cultures. Discusses how to use this science to facilitate cultural agility development. Presents frameworks to understand cultural values; explains cultural curiosity and tolerance of ambiguity; emphasizes cultural responses such as adaptation, minimization, and integration; and studies living and working in a host country. Offers students an opportunity to develop self-management and relationship-management competencies in diverse cultural environments.

**Attribute(s):** NUpath Interpreting Culture

**INTB 3310. Cultural Aspects of International Business. (4 Hours)**

Helps develop awareness of the hidden influence of culture on behavior, particularly with respect to management and management practices. With the increasing globalization of business, many managers find themselves being managed by, or collaborating with, people of different nationalities and cultures. Develops the ability to recognize, understand, and work with the cultural diversity that affects business conducted across national and cultural boundaries.

**Prerequisite(s):** INTB 1203 with a minimum grade of D- or INTB 1205 with a minimum grade of D- or INTB 1209 with a minimum grade of D-

**INTB 3320. International Business Management and Environment. (4 Hours)**

Examines contemporary issues that confront today's global managers. Explores the responses multinational enterprises have to the challenges of globalization. Seeks to build an understanding of the environment of international business while addressing the competencies required of global managers. Offers students an opportunity to develop a four-year professional development plan to guide their study and to help them develop the global mind-set necessary for becoming an effective global manager. Analyzes the political, economic, and sociocultural environment in which global businesses operate.

**INTB 3330. Digital Globalization. (4 Hours)**

Examines the opportunities and challenges that digitalization presents for international business. Explores digitalization processes at the societal, country, and company levels across various international contexts, including both developed and emerging markets. Investigates the cost and benefits of digitalization for governments; countries; and different types of companies such as analog firms, platform-based businesses, and family enterprises within the global landscape.

**INTB 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INTB 4202. Executing Global Strategy. (4 Hours)**

Emphasizes global strategy and the leadership requirements necessary to execute global strategy. Offers a capstone, "big picture" course that draws on and integrates all business fields and presents a global manager's perspective. Uses the knowledge acquired in core courses—such as finance, accounting, operations, marketing, and organizational behavior—along with their international dimensions, to study how global managers reach strategic management decisions for the firm and its role in society. Offers students an opportunity to review and revise their professional development plans following their return from the expatriate experience and begin to develop post-Northeastern PDPs.

**Prerequisite(s):** INTB 2205 with a minimum grade of D- ; INTB 2206 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**INTB 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated without limit.

**INTB 4983. Special Topics in International Business. (4 Hours)**

Examines areas of current interest and special topics in the field of international business. May be repeated once.

**INTB 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INTB 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of faculty members of the department on a chosen topic. Course content depends on instructor. May be repeated up to four times for a maximum of 8 semester hours.

**INTB 4998. International Business Undergraduate Thesis Continuation. (0 Hours)**

Offers thesis continuation for students in the BSIB program who are working on their thesis as part of the dual-degree requirements. May be repeated once.

**INTB 6200. Managing the Global Enterprise. (3 Hours)**

Focuses on the international business environment, and examines the influence on global decision making of such areas as the international economy and trade issues, legal and political context differences, governmental actions, cultural and ethical system differences, exchange rates and international currency markets, international institutions like the World Trade Organization and the International Monetary Fund, and regional agreements like the European Union, NAFTA, and Mercosur. Also analyzes why firms internationalize their operations, how they can internationalize, and key areas such as international manufacturing, marketing, human resource management, and strategy.

**INTB 6212. Cultural Aspects of International Business. (3 Hours)**

Focuses on issues that arise when a firm operates in multiple countries with cultures that are different from its home country. Principally addresses the perspectives of U.S. firms operating overseas, but also explores other national firms operating in the United States and in third-country environments. A central issue is how corporate cultures evolve in the context of national cultures.

**INTB 6224. Competing to Win in Emerging Markets. (3 Hours)**

Offers students an opportunity to develop an understanding of emerging markets. Analyzes how U.S. firms enter emerging markets and compete with emerging market firms and how emerging market companies compete with developed market companies and with each other. Explores the future of emerging markets and the steps they need to take to ensure their future viability and success, as well as the threats they face.

**INTB 6226. Becoming a Global Leader. (3 Hours)**

Seeks to help students build the cross-cultural skills necessary to comfortably and effectively work in different cultures and with people from different cultures. Discusses the alignment between the firm's business strategy and the leader's responses in a multicultural environment along with the methods for leadership effectiveness in multicultural teams and virtual environments. Using online, experiential, and discussion-based methods, offers students an opportunity to gain the self-awareness needed to generate a plan for their own global leadership development.

**INTB 6230. Global Field Study. (3 Hours)**

Designed to give students intense exposure to the global business environment by immersing them in the business practices and culture of a designated country or region. The course is taught primarily in the country or region of interest and involves a mix of classes, company site visits, and cultural activities. May be repeated once.

**INTB 6238. Global Project. (3 Hours)**

Offers students an opportunity to work on faculty-led teams to address a current issue facing a global corporate partner organization. Students interact directly with organizational leaders and employees to scope the project and work as a consulting team, harnessing campus and corporate resources to solve a problem and/or make recommendations. Faculty travel with the students to an international site to continue research, interviews, etc., and report findings to local corporate representatives. Feedback on the project reports are incorporated, and the final project report takes place post-travel with the corporate/sponsoring organizations' representatives.

**INTB 6249. Digitization of International Business. (3 Hours)**

Expose students to the opportunities and challenges that digitalization presents for the core tenets and managerial practices of international business. New digital technologies have given rise to digitally born companies that internationalize through online platforms at an exponential pace. Companies from unrelated industries that may have traditionally not competed against each other now co-create value on digital platform ecosystems. Countries are increasingly implementing policies that aim to bridge the digital divide and alleviate poverty. A darker side of digitalization has also emerged. While some countries push for a global and open internet infrastructure, others engage in digital protectionism. Artificial intelligence can further be abused for digital authoritarianism purposes. Data privacy breaches are also rising globally. Examines how companies, industries, and governments should respond.

**INTB 6260. Advanced Topics in Global Management and Strategy. (3 Hours)**

Offers topics of current interest in the international business arena, emphasizing managing in emerging markets, analyzing global expansion, and developing analytical and quantitative modeling skills for the international business arena, often in the context of developing presentation and writing skills in a case competition format. Instructor interests will shape course format and meeting schedules. May be repeated without limit.

**INTB 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INTB 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

## Interpreting (INTP)

**INTP 1000. American Sign Language at Northeastern. (1 Hour)**

Intended for freshmen and transfer students in the College of Social Sciences and Humanities who have interest in the ASL-English interpreting major and combined majors. Introduces freshmen to the liberal arts in general, campus and program resources, and the diverse makeup of the American Deaf Community. Offers students an opportunity to develop the academic skills necessary to become a successful university student (analytical ability and critical thinking); obtain grounding in the culture and values of the university community; and develop interpersonal skills.

**INTP 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INTP 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INTP 3500. The Interpreting Profession. (2 Hours)**

Presents an overview of the ASL-English interpreting profession. Discusses the emergence of sign language interpretation and translation; the responsibilities, ethics, and aptitudes of interpreters; professional associations; the bilingual and bicultural context; basic translation and interpretation; environments where interpreters work; special populations; and professional interpreter certifications.

**Prerequisite(s):** AMSL 2101 (may be taken concurrently) with a minimum grade of C

**INTP 3510. Interpreting Inquiry Texts. (4 Hours)**

Focuses on the practical skills required for effective translation and interpretation in dialogue-type inquiry texts (job interviews, case histories, and applications). Presents an overview of linguistic and sociolinguistic features and situational aspects of inquiry texts. Introduces theoretical models of interpretation to students' development of analytic and cognitive skills, in order that they may effectively identify message meaning and manage the cognitive processes of message transfer. Introduces intralingual translation and text analysis techniques. Offers students an opportunity to develop skills in translation, consecutive interpretation, and simultaneous interpretation and to gain decision-making skills and strategies to achieve cross-culturally effective and appropriate message mediation in contexts where interactive inquiry texts occur.

**Prerequisite(s):** AMSL 2102 with a minimum grade of D-

**INTP 3515. Interpreting Narrative Texts. (4 Hours)**

Focuses on the translation and interpretation of narrative texts (personal narratives, storytelling) and the development of strategic decision-making skills within the context of narrative texts. Presents an overview of linguistic and sociolinguistic features and situational aspects of narrative texts. Guides students in building cognitive processes and skills in translation, consecutive interpretation, simultaneous interpretation, and team interpretation. Offers students an opportunity to develop the decision-making skills needed for achieving cross-cultural, cross-linguistic message mediation in these settings.

**Prerequisite(s):** INTP 3510 with a minimum grade of D-

**INTP 3550. Interpreting Scripted Texts. (4 Hours)**

Guides students through the process of analyzing and interpreting frozen texts (plays, poems, and ceremonial scripts), from first read-through to final interpreted rendering of the performed text. Interpreting for theatrical or otherwise scripted communication is markedly different from other forms of interpreting. The availability of a script, ample time to rehearse, and the possibility of feedback makes this a hybrid practice—part interpreting, part translation, and part performance. Offers students an opportunity to learn how to analyze scripts for both content and interpreting issues; how to solve production problems of logistics, placement, and lighting; and how to interpret a series of performances for the Deaf Community. This course is offered in conjunction with or in advance of a theatre department production or other performed text.

**Prerequisite(s):** AMSL 2102 with a minimum grade of D- ; (ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**INTP 3970. Research Methods. (4 Hours)**

Offers an overview of research methodologies for ASL or interpreting majors preparing for their research capstone projects. Focuses on foundational theoretical knowledge and skills in research design, hypothesis testing, sampling and measurement, research ethics with deaf populations, as well as basic data analysis and interpretation. Offers students an opportunity to evaluate current literature in the discipline, write a project proposal to plan a research study or community-based project, and link social science research methods to sign language, deaf studies or interpreting and translation practice.

**Prerequisite(s):** INTP 3500 with a minimum grade of C

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Writing Intensive

**INTP 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INTP 4510. Interpreting Expository Texts. (4 Hours)**

Focuses on the interpretation of expository texts (lectures, procedural texts) and the development of strategic decision-making skills within the context of expository texts. Presents an overview of linguistic and sociolinguistic features and situational aspects of expository texts. Reinforces models of interpretation in students' practical development of analytic and cognitive skills, in order that they may effectively identify and transfer message meaning. Offers students an opportunity to further develop the cognitive processes and team interpretation skills to manage temporal constraints of simultaneous interpretation and to develop and apply the decision-making skills needed for achieving cross-cultural, cross-linguistic message mediation in these settings.

**Prerequisite(s):** INTP 3515 with a minimum grade of D-

**INTP 4515. Interpreting Persuasive Texts. (4 Hours)**

Focuses on the interpretation of persuasive texts (solicitation, political speeches) and the development of strategic decision-making skills within the context of persuasive texts. Presents an overview of linguistic and sociolinguistic features and situational aspects of persuasive texts. Offers students an opportunity to advance their analytic and cognitive skills for effectively identifying persuasive intent and meaning, in order to render accurate message transfer. Students practice and apply the cognitive processes and skills involved in translation, consecutive interpretation, and simultaneous interpretation with a goal of achieving effective cross-cultural, cross-linguistic message mediation in these settings.

**Prerequisite(s):** INTP 4510 with a minimum grade of D-

**INTP 4650. Ethical Decision Making. (4 Hours)**

Explores ethical standards and dilemmas in American Sign Language-English interpreting and other professions through discussions, hypothetical situations, and role-playing. Topics include culturally objective standards, ethics and professional principles, power relations within groups, and the Registry of Interpreters for the Deaf (RID) code of ethics. Compares various alternatives (i.e., consequence-based ethics) to a duty-based approach to the RID code and draws upon ethical fieldwork experience to analyze the principles that guide ethical decision making among professional interpreters.

**Prerequisite(s):** INTP 3515 with a minimum grade of C

**Corequisite(s):** INTP 4651

**Attribute(s):** NUpath Ethical Reasoning

**INTP 4651. Ethical Fieldwork. (2 Hours)**

Comprises the fieldwork component of INTP 4650. Places students in practical interpreting experiences in educational settings, agencies serving Deaf people, and with freelance interpreters. Focuses on ethical questions and dilemmas and decision making in a bi-weekly seminar format. Requires students to maintain a log and participate in online discussions. Fulfills the experiential education requirement for ASL majors.

**Prerequisite(s):** INTP 3515 with a minimum grade of D-

**Corequisite(s):** INTP 4650

**INTP 4940. Interpreting Research Capstone. (4 Hours)**

Requires students to undertake a research project focused on some aspect of American Sign Language-English interpretation. Students work individually or in research teams (with approval). In consultation with a faculty advisor, students select a research question, design and implement the data collection component of the project, analyze results, and write up their research findings. In addition to a written report, students also present their research results to ASL majors and community stakeholders at an annual ASL research symposium.

**Prerequisite(s):** INTP 3970 (may be taken concurrently) with a minimum grade of B-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**INTP 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**INTP 4995. Interpreting Practicum. (4 Hours)**

Places students in practical interpreting experiences in educational settings, agencies serving Deaf people, and with freelance interpreters. Requires students to record a set number of hours interpreting with supervision and analyze their work with the supervising interpreter. Students maintain a log, participate in discussions, present case studies drawn from their supervised work experience in seminars, and create a professional development plan for postgraduation. Fulfills the experiential education requirement for ASL majors.

**Prerequisite(s):** INTP 4651 with a minimum grade of S or INTP 4651 with a minimum grade of D-

**Attribute(s):** NUpath Integration Experience

**Italian (ITLN)****ITLN 1101. Elementary Italian 1. (4 Hours)**

Designed for students with very little or no prior knowledge of Italian. Provides a lively introduction to basic oral expression, listening comprehension, and elementary reading and writing. Each lesson incorporates helpful information about daily life in Italy and the varied cultures within the world of Italian speakers. Laboratory practice complements class work, enables students to work aloud at their own speed, reinforces their acquisition of essential structures, and acquaints them with a vast library of audio-visual resources.

**ITLN 1102. Elementary Italian 2. (4 Hours)**

Continues ITLN 1101. Reviews and continues the study of grammar and basic language skills. Offers progressively more intensive practice in oral and written communication. Laboratory practice complements class work, enables students to work aloud at their own speed, reinforces their acquisition of essential structures, and acquaints them with a vast library of audio-visual resources.

**Prerequisite(s):** ITLN 1101 with a minimum grade of C- or ITLN 1301 with a minimum grade of C-

**ITLN 1251. Dante's "Inferno" and Medieval Italian Culture. (4 Hours)**

Presents an overview of Dante's "Commedia," with a focus on the first book, "Inferno." Explores the descending levels of hell, analyzing the historical and cultural context of Dante's time, including political events and social structures. Examines theological concepts such as sin, punishment, redemption, and the afterlife from the perspective of Christian theology. Through the literary analysis of selected chapters (*canti*), evaluates the potential relevance of the poem to the modern human condition and to the reader's own experiences. Taught in English.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Interpreting Culture

**ITLN 1290. Realism and Modernism in Italian Film. (4 Hours)**

Examines the significance of postwar Italian cinema as a crucial platform for cultural expression by exploring some of the most influential films and directors from the neorealism era to the 1970s. Analyzes neorealism film, considering its role in empowering marginalized groups and reshaping Italy's cinematic landscape. Explores how issues such as class divisions, culture conflicts, and ideological debates are portrayed in films, with the aim of influencing and redefining Italian unity and identity. Investigates the sociocultural repercussions of the economic boom of the 1950s and 1960s, particularly in the transition toward modernism in cinema. Offers students an opportunity to appreciate the aesthetic expressions within Italian cinema and to explore the connection between film styles and practices with their historical and cultural contexts. Conducted in English.

**Attribute(s):** NUpath Interpreting Culture

**ITLN 1503. Introduction to Italian Culture. (4 Hours)**

Explores the construction of an Italian national cultural identity through a historical and cross-disciplinary perspective from the Middle Ages; the Renaissance; and the modern, post-WWII period. Organized into modules that focus on the major issues related to the idea of unity and division such as north and south divide, regionalism, language pluralism, fascism and dissent, criminal organizations, and migration. Conducted in English.

**Attribute(s):** NUpath Interpreting Culture

**ITLN 1973. Special Topics in Italian Culture. (4 Hours)**

Presents an in-depth exploration of aspects of Italian cultural, social, and intellectual history, which could include literature, philosophy, art, education, politics, gender, and society. Emphasizes critical analysis of primary and secondary sources, historical context, and interdisciplinary perspectives to deepen students' understanding of Italy's rich heritage and its place within global intellectual discourse. Themes and topics vary. Taught in English. May be repeated twice.

**ITLN 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ITLN 2101. Intermediate Italian 1. (4 Hours)**

Emphasizes further vocabulary building and mastery of fine points of grammar through written composition, prepared oral reports, and reading and discussion from current Italian periodicals.

**Prerequisite(s):** ITLN 1102 with a minimum grade of C- or ITLN 1302 with a minimum grade of C-

**ITLN 2102. Intermediate Italian 2. (4 Hours)**

Continues ITLN 2101. Emphasizes further vocabulary building and mastery of fine points of grammar through written composition, prepared oral reports, and reading and discussion from current Italian periodicals.

**Prerequisite(s):** ITLN 2101 with a minimum grade of C- or ITLN 2301 with a minimum grade of C-

**ITLN 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ITLN 3101. Advanced Italian 1. (4 Hours)**

Stresses the fundamentals of Italian to promote effective self-expression through speaking and writing and to explore the idiomatic aspects of the language. Through progressive class discussions and oral and written commentaries, students analyze a contemporary Italian novel or a Italian cultural reader, screenplay, or collection of short stories. The course strives, first, to help students read and comprehend modern Italian writing with confidence and to be able to talk and write about it in good Italian; and second, to provide preparation for advanced courses.

**Prerequisite(s):** ITLN 2102 with a minimum grade of C- or ITLN 2302 with a minimum grade of C-

**ITLN 3102. Advanced Italian 2. (4 Hours)**

Continues ITLN 3101. Enhances and reinforces language and communication skills that students encounter when they are abroad.

**Prerequisite(s):** ITLN 3101 with a minimum grade of C- or ITLN 3301 with a minimum grade of C-

**ITLN 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ITLN 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ITLN 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**ITLN 4992. Directed Study. (1-4 Hours)**

Offers students a way of going beyond work given in the regular curriculum; may also enable students to complete major or minor requirements in certain situations. Priority is given to language majors and to juniors and seniors. May be repeated without limit.

**ITLN 5976. Directed Study. (1 Hour)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

## Japanese (JPNS)

### **JPNS 1101. Elementary Japanese 1. (4 Hours)**

Introduces basic grammar, sentence patterns, and vocabulary of Japanese with emphasis on spoken Japanese. Includes an introduction to the hiragana and katakana syllabaries in the written component. Designed for students with no previous knowledge of Japanese.

### **JPNS 1102. Elementary Japanese 2. (4 Hours)**

Continues JPNS 1101. Emphasizes the development of oral skills; secondary emphasis is on reading. Offers students the opportunity to learn basic grammatical patterns, expand vocabulary, and improve communication skills in modern Japanese. Includes the introduction to kanji characters in the written component.

**Prerequisite(s):** JPNS 1101 with a minimum grade of C- or JPNS 1301 with a minimum grade of C-

### **JPNS 1260. Japanese Film. (4 Hours)**

Provides an introduction to Japanese film through works by such great masters as Kurosawa, Mizoguchi, and Ozu, as well as works by new directors from the 1980s and 1990s such as Tami, Morita, and Suo. Studies both form and content; relates major works to Japanese culture. Conducted in English.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

### **JPNS 1700. Introduction to Japanese Pop Culture. (4 Hours)**

Provides an introduction to Japanese popular culture through critical analysis of mass media such as film, television, comics, and animation. Investigates various social and cultural issues, such as gender, family, and education. Films and videos supplement readings. Conducted in English.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

### **JPNS 1944. Cultural Engagement: Dialogue of Civilizations. (4 Hours)**

Engages students on-site with the culture(s) of Japanese-speaking regions and/or communities. Emphasizes the complexity, transnationalism, and interdisciplinary nature of culture(s). Employs a range of methodological approaches to describe and analyze how cultural practices, objects, texts, and meanings are created, distributed, and exchanged within particular social groups or geographic areas. Explores questions of cultural identity, meaning, representation, policy formations, and ideologies. In addition to regular in-class lectures and activities, offers students an opportunity to engage in a dialogue with members of the local communities about their perspectives on relevant cultural topics and everyday experiences. May be repeated once. Conducted in English.

### **JPNS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **JPNS 2101. Intermediate Japanese 1. (4 Hours)**

Emphasizes further vocabulary building. Offers students an opportunity to master the fine points of grammar through written composition, prepared oral reports, and reading and discussion from contemporary Japanese materials.

**Prerequisite(s):** JPNS 1102 with a minimum grade of C- or JPNS 1302 with a minimum grade of C-

### **JPNS 2102. Intermediate Japanese 2. (4 Hours)**

Builds on JPNS 2101 and focuses on further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through written composition, prepared oral reports, and reading and discussion from contemporary Japanese materials.

**Prerequisite(s):** JPNS 2101 with a minimum grade of C- or JPNS 2301 with a minimum grade of C-

### **JPNS 2301. Intermediate Japanese Immersion 1. (4 Hours)**

Designed for students who are in a Japanese-speaking country, this is an off-campus immersion course. Offers students an opportunity to continue to develop grammatical and conversational competence. Focuses on oral and aural skills that are enhanced by the immersion environment.

### **JPNS 2302. Intermediate Japanese Immersion 2. (4 Hours)**

Designed for students who are in a Japanese-speaking country, this is an off-campus immersion course. Offers students an opportunity to continue to develop grammatical and conversational competence. Focuses on oral and aural skills that are enhanced by the immersion environment.

**JPNS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**JPNS 3101. Advanced Japanese 1. (4 Hours)**

Continues further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through advanced reading, composition, grammar review, and listening skills. Whenever possible, offers students an opportunity to engage in local community activities to enhance communication skills and cultural knowledge.

**Prerequisite(s):** JPNS 2102 with a minimum grade of C- or JPNS 2302 with a minimum grade of C-

**JPNS 3102. Advanced Japanese 2. (4 Hours)**

Builds on JPNS 3101 and continues further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through advanced reading, composition, grammar review, and listening skills. Whenever possible, offers students an opportunity to engage in local community activities to enhance communication skills and cultural knowledge.

**Prerequisite(s):** JPNS 3101 with a minimum grade of C- or JPNS 3301 with a minimum grade of C-

**JPNS 3301. Advanced Japanese Immersion 1. (4 Hours)**

Designed for students who are in a Japanese-speaking country, this is an off-campus immersion course. Offers students an opportunity to continue to develop grammatical and conversational competence.

**JPNS 3302. Advanced Japanese Immersion 2. (4 Hours)**

Designed for students who are in a Japanese-speaking country, this is an off-campus immersion course. Offers students an opportunity to continue to develop grammatical and conversational competence.

**JPNS 3800. Special Topics in Japanese. (1-4 Hours)**

Focuses on specific aspects of Japanese language and culture. May be repeated twice for a maximum of 12 semester hours, when topics vary.

**Prerequisite(s):** JPNS 2102 with a minimum grade of C-

**JPNS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**JPNS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**JPNS 4992. Directed Study. (1-4 Hours)**

Offers students a way of going beyond work given in the regular curriculum; may also enable students to complete major or minor requirements in certain situations. Priority is given to language majors and to juniors and seniors. May be repeated without limit.

**JPNS 5976. Directed Study. (1 Hour)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

## Jewish Studies (JWSS)

### **JWSS 1285. Jewish Religion and Culture. (4 Hours)**

Explores some of the rich variety of Jewish cultural expressions and interpretive traditions, including the Jewish life cycle (birth through death) and the calendar cycle (holidays and daily rituals). Judaism is an ancient, living religious civilization that has evolved continuously over the millennia and around the globe. Offers students an opportunity to become familiar with the major periods of Jewish history and study exemplary formative Jewish texts (from the Bible and its interpreters through rabbinic, legal, and later literatures). Studies the global diversity of Jewish traditions, cultures, and identities, including how Jewish religion and culture have been influenced by the communities in which Jews have lived and live. No prior knowledge of Judaism is necessary or assumed.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

### **JWSS 1294. History of the Jews in the Modern World. (4 Hours)**

Surveys the history of the Jews in the modern world, with an emphasis on global cultural exchange. Examines Jewish interaction with non-Jewish society from Europe to North Africa, the Middle East, the Soviet Union, Israel, and the United States and explores this relationship's creative and destructive consequences. Focuses on how Jewish society, culture, religious practice, and political definition changed in relation to a variety of processes now associated with modernity, such as urbanization, industrialization, state centralization, and the development of nationalism and secularism.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

### **JWSS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **JWSS 2259. Sex, Gender, and Judaism. (4 Hours)**

Introduces the representation of sex and gender in Jewish culture and religion. Explores varied representations of masculinity and femininity over time and place within Jewish communities; the role of biblical texts in the construction of Western conceptions of gender and sexuality; and how contemporary feminist, queer, and other sexual identities have influenced Jewish practices. Readings draw from a range of primary sources (memoirs, fiction, religious texts, etc.) and critical literature.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

### **JWSS 2282. The Holocaust and Comparative Genocide. (4 Hours)**

Examines the origins of the Holocaust, perpetrators and victims, and changing efforts to come to terms with this genocide. The Holocaust, the murder of 6 million Jews by Germans in Nazi-occupied Europe during World War II, is one of the crucial events of modern history. Investigates the uniqueness of the Holocaust relative to other acts of ethnic cleansing or genocide, including mass death in the New World and mass murder in Armenia, Bosnia, and Rwanda.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

### **JWSS 2431. Immigration and Identity in the American Jewish Experience. (4 Hours)**

Examines Jewish political, social, and cultural history from the arrival of the first group of Jews at New Amsterdam in 1654 to the present. Themes include immigration, adaptation, family life, religion, anti-Semitism, Zionism, the Holocaust, and American-Israeli relations.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

### **JWSS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **JWSS 3678. Bedrooms and Battlefields: Hebrew Bible and the Origins of Sex, Gender, and Ethnicity. (4 Hours)**

Considers stories from Hebrew Scripture in English translation, beginning with the Garden of Eden through the Book of Ruth, asking how these foundational narratives establish the categories that have come to define our humanity. Analyzes how the Bible's patterns of representation construct sexual and ethnic identities and naturalize ideas about such social institutions as "the family." ENGL 3678, JWSS 3678, and WMNS 3678 are cross-listed.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or

ENGW 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture

**JWSS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**JWSS 4660. Jewish Studies Module. (1 Hour)**

Permits specialized Jewish studies topics to be studied as part of more general courses. May be repeated without limit.

**JWSS 4992. Directed Study. (1-4 Hours)**

Offers students an opportunity for special readings and research in Jewish studies. May be repeated for up to 8 total credits.

## Journalism (JRNL)

**JRNL 1000. Journalism at Northeastern. (1 Hour)**

Intended for first-year students in the College of Arts, Media and Design. Introduces students to liberal arts; familiarizes them with their major; develops the academic skills necessary to succeed (analytical ability and critical thinking); provides grounding in the culture and values of the University community; and helps to develop interpersonal skills—in short, familiarizes students with all skills needed to become a successful university student.

**JRNL 1101. Journalism 1: Fundamentals of Reporting and Writing. (4 Hours)**

Covers the foundations of newswriting, including leads, story structure, objective tone, and attribution. Introduces fundamental reporting skills such as interviewing, researching, and observation. Asks students, in their reporting, to step back and analyze the institutions they are writing about and the media itself in order to understand how societies and their institutions function and the validity of theories that explain these processes. Also explores how journalistic writing is leveraged on various publishing platforms and by different types of media organizations.

**Corequisite(s):** JRNL 1102

**Attribute(s):** NUpath Creative Express/Innov, NUpath Societies/Institutions, NUpath Writing Intensive

**JRNL 1102. Journalist's Toolbox. (1 Hour)**

Introduces the tools journalists use to tell stories that will be utilized in Journalism 1 and beyond. Covers introductory photo, audio, video, and data visualization skills. Exposes students to other journalistic tools including social media and blogging. Offers students an opportunity to become familiar with composition of photos, recording and editing audio and video on nonlinear software, and how data visualizations can enhance journalistic storytelling.

**Corequisite(s):** JRNL 1101

**JRNL 1150. Understanding Today's News. (4 Hours)**

Examines the media institutions that shape the news and how the challenges of economics, politics, diversity, and globalization change the function of the website, newspaper, news magazine, and news broadcasts. Examines stories and news decisions from different perspectives to evaluate national, political, local, foreign, sports, and science news in the U.S. media. Topics include responsibilities of the press and the changing ways news is gathered, processed, and disseminated. Explores how other societies in different parts of the world view the news; freedom of the press; and the role of reporters, producers, and editors.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**JRNL 1160. Science, Media, and the Public. (4 Hours)**

Introduces students to the primary mechanisms behind science communication—how scientific knowledge is produced then disseminated to the public through both academic and popular media, and how this process involves tensions between actors with differing, sometimes contradictory imperatives. Focuses on the fraught relationship between a scientific establishment often beholden to powerful commercial interests and journalists who seek to advocate for public accountability and accurately communicate scientific knowledge while working within organizations that often put corporate profits above editorial integrity.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**JRNL 1949. Covering Race in Pop Culture and the Media. (4 Hours)**

Engages and revisits how lyrics, songs, movies, articles, and books inform race and how race informs them. As journalists are required to cover a myriad of subjects, it is vital to recognize the various ways in which race informs a cultural awareness. How do people infuse that awareness into what journalists do? Students read, watch movies, and listen to music, all through a lens of critical revision. Examines pop culture and media outputs that have influence over the creation of our perceptions of race while, at the same time, revise how race does and should influence information accessed through the media. Offers students an opportunity to produce high-quality short as well as narrative, long-form, feature-length articles.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**JRNL 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**JRNL 2100. Coding Truth: Misinformation in the Digital Era. (4 Hours)**

Presents the emerging world of digitally scaled mis- and disinformation. Explores the intersection of mis- and disinformation, data, and politics, showcasing how technology amplifies or mitigates the spread of mis- and disinformation. Involves a critical analysis of digital mis- and disinformation within contemporary societies. Addresses how multiple stakeholders such as journalists, governments, platforms, and public institutions can navigate and combat information disorder, offering insights into the future landscape of this evolving challenge.

**JRNL 2200. Writing for Public Relations. (4 Hours)**

Immerses students in various kinds of writing required to conduct effective public relations on behalf of companies, organizations, and individuals, both to enhance their public images and protect their reputations. Explores communications theories and, in particular, how they influence writing in an era dominated by social and digital media. Covers various forms of public relations writing, including press releases, press conferences, media pitches, company histories, video scripts, speeches, and advertorials. Studies how to present client positions through op-eds, letters to the editors, newsletters, and other vehicles; how to adapt communications for company websites and social media channels; and how to draft communications for key company stakeholders, especially employees.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**JRNL 2201. Journalism 2: Intermediate Reporting. (4 Hours)**

Continues JRNL 1101. This is the second writing course for undergraduate journalism students with an emphasis on learning how to report news stories. Offers students the opportunity to find sources and interview them, do background research, and use public records. Developing story ideas using computer-assisted reporting will be covered. Examines how to develop a story idea and then focus and organize it. Covers basic principles of online journalism including writing, design, and integration of visuals and text for the Web. Introduces elements of design and layout.

**Prerequisite(s):** JRNL 1101 with a minimum grade of C

**JRNL 2250. Spotlight: The Story of Journalism and Democracy. (4 Hours)**

Offers an overview of groundbreaking stories and the journalistic methods used to produce them. Seeks to facilitate broad understanding of why a free press matters in a democratic society. Offers a behind-the-scenes look at examples of great investigative journalism that changed American history and explores the media's capacity to hold the powerful accountable. From Watergate to WikiLeaks and beyond, students critically analyze important news stories that helped reshape society. Reviews major stories, films, and interactive media and studies the methods used to report and produce such stories, including methods used by the Boston Globe Spotlight team and seen in the Oscar-winning movie "Spotlight." Focuses on researching documents as well as interviewing techniques.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**JRNL 2285. America and the Holocaust. (4 Hours)**

Examines the American response to the Holocaust, in terms of both contemporaneous knowledge and actions and the lasting impact on policy and culture. Starts with early twentieth-century events, such as the Armenian genocide, that shaped later attitudes. Explores the prewar period, particularly U.S. immigration and isolationist policies. Assesses Americans' knowledge of European events as the extermination campaign unfolded and fights ensued over rescue possibilities. Examines changing depictions of the Holocaust that emerged in the postwar period as a result of critical events such as the Eichmann trial and popular television and film portrayals. Finally, considers how perceptions of the Holocaust have shaped subsequent U.S. responses to genocide. HIST 2285, JRNL 2285, and JWSS 2285 are cross-listed.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**JRNL 2301. Visual Storytelling in Journalism. (4 Hours)**

Continues JRNL 2201. Covers basic principles of journalistic storytelling with video, sound, and still images. Introduces students to the foundations of writing with audio and video, and explores the concept of "convergence," preparing stories for presentation in different formats. Fulfils the Advanced Writing in the Disciplines requirement for journalism majors.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**JRNL 2350. The History of Journalism: How the News Became the News. (4 Hours)**

Traces the development of American journalism from its European and English beginnings. Topics include the colonial press, the great personal journalists of the nineteenth century, and the impact of major technological changes in mass communications media in the twentieth century.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions, NUpath Writing Intensive

**JRNL 2800. The Bigger Picture: Sports Journalism Beyond the Box Score. (4 Hours)**

Explores the future of sports journalism, in particular how sports, society, and innovations in digital storytelling come together to stimulate important conversations around issues such as gender, race, class, and equity. Focuses on preparing students to research, formulate, and pitch stories to local and national media. Serves as a digital laboratory for class work, offering students experiential knowledge through direct practice. Issues of ethics, source diversity, audience engagement, and story construction decision-making will be central to the course.

**Attribute(s):** NUpath Creative Express/Innov

**JRNL 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**JRNL 2991. Research in Journalism. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision.

**JRNL 3300. Covering Conflicts: Peace, War, and the Media. (4 Hours)**

Examines the media's portrayal of conflicts and the peace process in the Middle East, Northern Ireland, Bosnia, Rwanda, and elsewhere. Evaluates the limits of fairness, balance, and accuracy in the coverage. Looks at the U.S. and international media—print, broadcast, and online—and some of the major stories in recent years and attempts to put these stories in historical, political, and social context. Analyzes the wide-ranging criticism of coverage from a variety of perspectives. INTL 3300 and JRNL 3300 are cross-listed.

**JRNL 3305. Special Topics. (4 Hours)**

Offers specialized topics in journalism for the twenty-first century. Topic matter changes each semester. May be repeated up to eight times.

**JRNL 3370. Podcast and Radio Journalism. (4 Hours)**

Covers the fundamentals of audio journalism in a hands-on environment. Offers students an opportunity to learn how to record and edit audio, write for the ear, interview for broadcast, and experiment with a wide range of radio and podcast formats and narrative techniques. Listening sessions and assignments explore the different requirements of spot news, radio features, reporter debriefs, host interviews, and longer-form audio storytelling, including documentary and serial-style podcasts. Emphasizes journalistic principles and ethical considerations.

**Attribute(s):** NUpath Creative Express/Innov

**JRNL 3455. Sports Writing. (4 Hours)**

Provides practice in journalistic coverage of amateur and professional athletics. Focuses on the role of sports writing in the news media and examines such topics as game coverage, feature profiles, and opinion columns.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Writing Intensive

**JRNL 3460. AI and Media Frontiers. (4 Hours)**

Explores AI tools and their utility in creating content, telling stories, and enhancing related workflows for user cases such as public relations and communications, advocacy and social impact, journalism and news, strategic social media campaigning, and the influencer-creator economy. Examines prompt engineering as a new discipline of structured, logical techniques for effective communication. Investigates capacities and functionality of generative AI tools that span text, images, visualization, and multimodal domains. Studies ethical frameworks to guide AI-driven media work and understand emerging societal issues that touch on areas such as deception, autonomy, agency, and transparency. Offers students an opportunity to actively interrogate limitations and biases of generative AI models and engage in debates relating to the development of responsible AI.

**Attribute(s):** NUpath Ethical Reasoning

**JRNL 3550. The First Amendment and the Media. (4 Hours)**

Examines legal problems of libel, invasion of privacy, and access to government information; discusses the balance between private rights and the public's "need to know."

**Attribute(s):** NUpath Capstone Experience, NUpath Ethical Reasoning, NUpath Societies/Institutions, NUpath Writing Intensive

**JRNL 3610. Digital Storytelling and Social Media. (4 Hours)**

Offers students an opportunity to learn the fundamentals of digital journalism. Emphasizes hands-on instruction in multimedia skills. Topics may include blogging, photography, video and audio production, use of social media as a reporting tool, and mapping and data visualization. Guest speakers and a consideration of the future of news may also be part of the course. Requires students to produce a final project that consists of storytelling across a range of platforms—for example, a written article, a photo story, and a video.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Writing Intensive

**JRNL 3630. Magazine Writing. (4 Hours)**

Covers writing and freelancing magazine articles; analyzing magazines as markets; and selecting the best feature format—how-to-do-it, profile, personal experience, human interest, interpretive pieces, and others. Requires a firm grasp of journalistic concepts, including advanced reporting and writing skills; a prior journalistic co-op or internship or experience writing for a school, online, or professional publication is preferred.

**JRNL 3650. Science Writing. (4 Hours)**

Explores the role of journalism in delivering science news and information to a general audience through print and digital media. Through readings and analysis of a variety of news media, offers students an opportunity to learn how political debates intersect with and shape scientific developments and how scientific developments can be sensationalized or misunderstood. Students also have an opportunity to learn and apply best journalistic practices to communicate effectively in the media about science, health, environmental, and technology issues whether headed to a newsroom, corporate press office, or scientific institution.

**Attribute(s):** NUpath Writing Intensive

**JRNL 3680. Advanced Reporting. (4 Hours)**

Offers students an opportunity to learn and apply advanced reporting techniques of the kind that editors and producers expect of their best reporters, especially those who cover demanding beats such as politics, government, healthcare, education, science, and business. Studies how to see and apply data and data visualization techniques, to develop and interview sources, to locate and decipher public records, to identify and conceptualize important stories, and to discuss and apply ethical theories to reporting to justify choices that may inflame or antagonize sources or readers. An assignment to do substantial enterprise stories for publication in major media outlets is part of the course.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Ethical Reasoning

**JRNL 3700. Data Storytelling. (4 Hours)**

Explores select topics in data journalism and supports data-driven storytelling projects of various kinds. Course units foster moderate technical learning of applications and software; incorporate theories from relevant fields in data visualization and data science; and emphasize storytelling for broad public audiences. Seeks to foster knowledge of both the classic and cutting-edge forms for telling stories with data. Offers students an opportunity to obtain a sense of rigor in analyzing and using data and statistics and to build knowledge of a variety of tools to clean, analyze, and visualize data. Journalists are becoming more sophisticated in their approaches to quantitative information, drawing on the growing amount of open data sets and using software and techniques borrowed from the social sciences and data science.

**Attribute(s):** NUpath Analyzing/Using Data

**JRNL 3945. Internship. (1-4 Hours)**

Comprises academic credit for internship work in journalism. May be repeated without limit.

**JRNL 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**JRNL 4370. Audio Storytelling. (4 Hours)**

Offers students with prior experience in journalism or podcasting an opportunity to learn advanced reporting, production, and narrative skills specific to audio journalism. Focuses on building skills applicable to a wide range of digital audio workstations. Explores the evolution of a documentary project from blueprint through production. Coursework consists primarily of team-based investigations that analyze major societal issues, with the goal of highlighting both stakes and solutions. Reveals the way collaborative processes can deepen and enhance major audio storytelling projects.

**Prerequisite(s):** COMM 1450 with a minimum grade of C or JRNL 1101 with a minimum grade of C or JRNL 3370 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**JRNL 4650. Ethics and Diversity in the News Media. (4 Hours)**

Discusses the responsibilities of news media and ethical problems confronting decision makers in different journalistic fields and the principles found in codes of various professional societies. Students read and discuss the news of the day as well as issues pertaining to diversity, technology, disinformation, objectivity, and professional standards. The final project consists of a major paper on an ethical issue in the news.

**Attribute(s):** NUpath Capstone Experience, NUpath Ethical Reasoning, NUpath Writing Intensive

**JRNL 4970. Junior/Senior Honors Project 1. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**JRNL 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**JRNL 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**JRNL 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**JRNL 5250. Gender in the Newsroom. (4 Hours)**

Explores the obstacles women in journalism face and examines how a lack of diversity can damage news organizations' credibility. Studies the historical underpinnings of journalism's gender gap and practical strategies to navigate identity politics in a modern newsroom. For decades, women have represented the majority of journalism and mass communication students, but they remain the minority at most U.S. news organizations. This gender gap is, of course, not unique to journalism, but the paucity of women in newsrooms negatively impacts society. When news narratives are constructed primarily by men, those narratives often perpetuate "symbolic annihilation"—a term commonly used by feminist and queer scholars to describe the ways the media overlooks or stereotypes women and other marginalized identities.

**Attribute(s):** NUpath Difference/Diversity

**JRNL 5309. News Documentary Production. (4 Hours)**

Offers students an opportunity to research, write, and produce a short news video documentary and acquaint themselves with a range of professional documentary styles through screenings and discussions. Emphasizes analyzing and addressing the ethical challenges facing documentary filmmakers and their interaction with subjects historically and in the new media age.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Ethical Reasoning

**JRNL 5310. Photojournalism. (4 Hours)**

Covers camera procedures along with cropping, assignment techniques, theory, and photo-caption methods. Engages students in the ethical choices photojournalists face in covering wars, disasters, and vulnerable people in societies—both historically and in the new media environment.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Ethical Reasoning

**JRNL 5311. Design for Storytelling. (4 Hours)**

Covers basic principles of print and digital design with lectures, skills training, and a maker's workshop. Introduces students to the foundations of typography, color, grids, and use of images for storytelling. Students design, prototype, and produce a print magazine and website.

**Attribute(s):** NUpath Creative Express/Innov

**JRNL 5314. Video News Reporting and Producing. (4 Hours)**

Engages students in the ethical challenges facing journalists historically and in the new media age. Students experiment with techniques used by TV and electronic news producers, including reporting, writing, videotaping, and editing on nonlinear digital editing equipment. Offers students an opportunity to create and produce news stories and upload them to their websites with a variety of software programs for dissemination across video and several multimedia platforms, in line with journalistic and ethical standards.

**Prerequisite(s):** JRNL 2201 with a minimum grade of C or graduate program admission

**Attribute(s):** NUpath Creative Express/Innov, NUpath Ethical Reasoning

**JRNL 5316. The Newsroom. (4 Hours)**

Immerses students in a real-life television newsroom experience. Exposes students to all aspects of TV news production: from news gathering, producing, and being in front of the camera to the behind-the-scenes work of operating multiple cameras, live switching, audio mixing, and studio lighting. Allows students to be an integral part of a newsroom team, working as reporters, anchors, videographers, and editors to gather content and work in the studio to produce a Northeastern newscast covering news on campus and beyond. Involves hands-on reporting and production where the stories are real and so are the deadlines.

**Attribute(s):** NUpath Creative Express/Innov

**JRNL 5320. Practicing Photojournalism: Community and the Camera. (4 Hours)**

Addresses current concerns in photojournalism including social justice, environmental justice, and diversity issues through the study of local/community photojournalism. Provides instruction in photographic and visual reporting skills through documenting ongoing concerns within the hyperlocal context of neighborhood and social communities. Guides students to produce original reporting with an emphasis on still photography and basic multimedia. Requires a firm grasp of basic photography concepts including manual exposure control, depth of field, and shutter function. Students should be able to comfortably operate a camera on the manual setting, recognize the differences between lenses, and be familiar with Adobe Photoshop and/or Adobe Lightroom, as well as possess basic writing and reporting skills, including approaching strangers for stories.

**Attribute(s):** NUpath Creative Express/Innov

**JRNL 5360. Global Reporting. (4 Hours)**

Discusses coverage of global issues and international public affairs and the function of the media in a global context. Topics include how news is gathered, processed, and disseminated by the various media abroad and how the media reflect culture, religion, and politics around the world. Focuses on practical, in-the-field experience with global governmental, business, and societal leaders. This course is part of the Dialogue of Civilizations program abroad. Graduate awards do not apply toward this program. International students wishing to register need to speak to the International Student and Scholar Institute prior to registration. May be repeated without limit.

**Attribute(s):** NUpath Difference/Diversity

**JRNL 5400. Media and Advocacy in Theory and Practice. (4 Hours)**

Examines time-tested and cutting-edge methods for shaping and presenting messages across multimedia platforms to effectively disseminate an organization's message, change a public conversation, or shift public opinion. Examines case studies in mainstream media, public advocacy, and strategic communications to explore the motivations and methods of the organizations as well as the tools and techniques used. Examines the practice of digital advocacy by exploring and applying pertinent findings from politics, advertising, and behavioral science that are increasingly employed by professionals looking to "micro-target" voters, "convert" customers, or "nudge" the public. One major component of the course is hands-on workshops through which students are offered an opportunity to learn how to leverage the latest digital tools for communicating across social media and online platforms.

**JRNL 5410. Innovation in the News Media Business. (4 Hours)**

Examines how the news media business has traditionally been run, how it has adapted (or not) to the digital tsunami, and what approaches show promise in the face of constant change. Presents readings in media theory, a thorough review of journalism business models, case studies in both traditional and digital media businesses, and guest lecturers from across the industry. Focuses on how digital advertising and subscription businesses have evolved during the digital transformation, including examination of the economics and practices of large social media platforms, digital streamers, new subscription tools, and industry consolidation.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Integration Experience, NUpath Societies/Institutions

**JRNL 5420. Public Relations Strategies for Managing Scandal in Business and Politics. (4 Hours)**

Studies public relations strategy and tactics for predicting, preparing for, and responding to a variety of crisis scenarios, building on a foundation of basic crisis management principles. Focuses on how to provide sound counsel before, during, and after a crisis and on the tools available to mount an effective crisis response. More than ever, individuals and organizations—politicians, executives, corporations, nonprofits, and government agencies, among others—are facing serious issues and crises that threaten their reputations.

**Attribute(s):** NUpath Societies/Institutions

**JRNL 5460. POV: The Art and Craft of Opinion Journalism. (4 Hours)**

Offers students an opportunity to learn how to write a variety of opinion articles in a journalistic context. Articles may include blog posts, op-ed columns, personal essays, reviews, and magazine-style stories that combine reporting with a strong point of view. Students are also offered an opportunity to learn about the ethics of opinion journalism, become familiar with the best practitioners in the field, and use social media to inform and promote their work.

**Attribute(s):** NUpath Writing Intensive

**JRNL 5480. Research for Media Strategy. (4 Hours)**

Offers an overview of the concepts, methods, and tools for social science research with a focus on media strategy. Covers how social science methodologies—including developing skills in gathering, organizing, interpreting, and presenting research information using competent and ethically defensible methods—are critical to in-depth media advocacy research.

**Attribute(s):** NUpath Analyzing/Using Data

**JRNL 5500. Coding for Digital Storytelling. (4 Hours)**

Offers students an opportunity to learn essential skills in coding across a wide range of technologies commonly used today in data-driven, multimodal, web-based storytelling. Focuses on building skills in basic web development, as well as exploring additional topics and technologies that fit into the broader landscape of data storytelling practice (JavaScript visualization library D3.js, basic Python, working with APIs, and working with databases). Coursework consists primarily of team-based projects that focus on reverse-engineering real-world examples of data storytelling to demystify the question, "How did they do that?" Reveals the ways fluency in code can transform storytelling.

**Attribute(s):** NUpath Creative Express/Innov

**JRNL 5550. Open-Source Investigations. (4 Hours)**

Explores case studies of path-breaking open-source investigations—social media posts linking soldiers to war crimes, satellite images showing environmental disasters, and photos revealing a hidden code for police shootings—to demonstrate how to use innovative reporting techniques. Offers students an opportunity to develop knowledge of these tools and strategies while creating an original investigation project.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Creative Express/Innov

**JRNL 5973. Topics in International Reporting. (4 Hours)**

Focuses each semester on a specific topic that is of timely relevance to journalists covering foreign affairs. Explores methods and challenges of reporting on global politics and culture, drawing on instructor expertise. Informed by current events, historical case studies, critical readings, instructor and guest lectures, and class discussions, students design original research and reporting projects in response to the course topic. Emphasizes developing skills and strategies for covering international stories, including self-directed and collaborative work in all aspects of conceiving, planning, and producing in-depth multimedia global journalism. May be repeated twice.

**JRNL 6100. Reporting and Writing Fundamentals. (1 Hour)**

Introduces the basics of news reporting and writing. Runs for three weeks beginning in mid-August.

**JRNL 6200. Enterprise Reporting 1. (4 Hours)**

Defines and sharpens research, interviewing, and analytical skills necessary for good reporting. Focuses on learning to develop story ideas and conduct primary and secondary research for a major enterprise article. Skills are developed through an analysis of outstanding reportage, in-class discussion and exercises, and out-of-class assignments.

**JRNL 6201. Enterprise Reporting 2. (4 Hours)**

Builds on skills and concepts covered in JRNL 6200. Covers a variety of Web-based and traditional resources. Employs computer-assisted reporting methodologies to assist students in investigating areas such as government corruption, safety and environmental risks, criminal justice, education, healthcare, real estate, campaign financing, and business and financial transactions. Offers students an opportunity to learn how to access public databases, to reference materials, and to analyze the information.

**Prerequisite(s):** JRNL 6200 with a minimum grade of C-

**JRNL 6202. Perspectives on News Media Ethics and Diversity. (4 Hours)**

Engages with vital issues of ethics, diversity, and First Amendment law as it pertains to journalism, public relations, and related media fields. Topics include codes of ethics, disinformation, technology, conflicts of interest, corporate ownership, and the meaning of objectivity. Students read and review a combination of contemporary and classic books. Additional readings include selected articles pertaining to course topics as well as issues involving news coverage of current events.

**JRNL 6305. Topics. (4 Hours)**

Requires advanced work to develop media skills not covered in other classes. May be repeated without limit.

**JRNL 6306. Media Innovation Studio 1. (4 Hours)**

Constitutes the first of a two-course studio sequence designed to prepare experienced journalists to create new forms of journalism in the digital age. Offers students an opportunity to work with faculty members and peers via class exercises and peer-to-peer project collaboration to identify and develop the subject of a signature master's project. Incorporates lectures on emerging media practices, including parallax scrolling, and instruction on digital journalism tools, including DSLR cameras, as well as reviews and critiques of professional and studio work by faculty and guest speakers.

**JRNL 6307. Media Innovation Studio 2. (4 Hours)**

Offers students an opportunity to integrate knowledge and skills derived from foundation courses to develop a master's project. Creates a newsroom environment in which each student project is advanced through a journalistic collaborative process that features critiques from instructors and peers and integrates expertise from guest lecturers. Following the "teaching hospital" model, students work with the instructor, each other, and partnered media innovation visitors to develop their work.

**Prerequisite(s):** JRNL 6306 with a minimum grade of C-

**JRNL 6340. Fundamentals of Digital Journalism. (4 Hours)**

Offers students an opportunity to learn the fundamentals of digital journalism and to place those skills within the context of a changing media environment. Studies multimedia tools within an intellectual framework—i.e., offers students an opportunity to learn hands-on skills and also to study best practices and theory. May include guest speakers and a consideration of the future of news. Requires students to produce a final project that consists of storytelling across a range of digital platforms.

**JRNL 6341. Telling Your Story with Data. (4 Hours)**

Explores select topics in data journalism and support data-driven storytelling projects of various kinds. Offers students an opportunity to learn how to navigate the often-competing demands of rigorous analysis and accessible narrative and storytelling. Course units are designed to foster moderate technical learning of applications and software, incorporate theories from relevant fields in data visualization and data science, and emphasize storytelling for broad public audiences.

**JRNL 6355. Seminar in Investigative Reporting. (4 Hours)**

Introduces students to the world of investigative reporting as it is practiced at major metropolitan newspapers. Asks students to work as members of investigative reporting teams and introduces them to advanced reporting techniques and standards in the classroom. Provides an opportunity to learn how ideas for investigative reporting projects are developed; how to identify and interpret public records and online databases; and how to do interviews and write investigative stories. Working in small teams, the students are given an opportunity to develop and write investigative stories for publication.

**JRNL 6460. AI in Media Industries. (4 Hours)**

Offers students an opportunity to develop practical skills in leveraging artificial intelligence tools to tell stories for use cases such as public relations and communications, advocacy and social impact, journalism and news, and strategic social media campaigning/influencer-creator economy. Uses generative AI tools that span text, images, and multimodal domains, experimenting with and evaluating different models and platforms. Presents practical knowledge of tools and their functionality, including limitations and biases, covering how to apply ethical frameworks to AI-driven media. Uses AI tools to develop stories relevant to local communities and to prototype potential products and workflows that can advance civic and enterprise goals. Collaborates with an external media partner firm, engaging in a two-way learning process to produce a deliverable for the external client.

**JRNL 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**JRNL 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**JRNL 6966. Practicum. (1-4 Hours)**

Provides eligible students with an opportunity for practical experience. May be repeated without limit.

**JRNL 7976. Directed Study. (1-4 Hours)**

Offers students work on individual projects under the supervision of an instructor. May be repeated without limit.

## Korean (KORE)

**KORE 1101. Elementary Korean 1. (4 Hours)**

Begins the integrated development of elementary language skills through cultural exploration. Includes class discussion and project-based learning. Offers students an opportunity to gain a deeper understanding of daily life, social norms, and family structure in Korea. Designed for students with little or no knowledge of Korean.

**KORE 1102. Elementary Korean 2. (4 Hours)**

Builds on KORE 1101 and continues the integrated development of elementary language skills through cultural exploration. Includes class discussion and project-based learning. Offers students an opportunity to gain a deeper understanding of the linguistic, cultural, and geographic diversity of the Korean peninsula.

**Prerequisite(s):** KORE 1101 with a minimum grade of C-

**KORE 1800. Introduction to Korean Pop Culture. (4 Hours)**

Introduces students to Korean popular culture with texts ranging from comics, films, K-drama, pop music, and popular novellas in translation. Explores how "Hallyu" (the Korean wave) reverberated through different Asian regions and the rest of the globe in the 1990s and 2000s and continues into the present through global fandoms and streaming platforms. Critically examines the rising popularity of Korean popular cultural genres and influences in various global contexts in relation to race, class, gender, ethnicity, social media, and youth culture. Conducted in English.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**KORE 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**KORE 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**KORE 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**KORE 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**KORE 5976. Directed Study. (1 Hour)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated up to three times.

**KORE 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

## Landscape Architecture (LARC)

**LARC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LARC 2130. Sustainable Urban Site Design. (6 Hours)**

Focuses on site planning and design with an emphasis on parks and open-space systems in the adaptive reuse of urban sites. Projects focus on the creation and cultivation of public space, transformation of site conditions, and development of sustainable site materials. Emphasizes site analysis, development of an individual design process, and design communication strategies. This studio course introduces students to urban design precedents, site research, and remediation methods through case studies, lectures, site visits, and workshops.

**Prerequisite(s):** ARCH 1110 with a minimum grade of D- ; ARCH 1120 with a minimum grade of D-

**LARC 2140. Designed Urban Ecologies. (6 Hours)**

Continues LARC 2130. Focuses on sustainable community/campus/neighborhood design at the intersection of large-scale urban and environmental systems. Primary topics include mixed-use programming in relation to systems ranging from zoning and transit to the material flows of human and wildlife habitats. This studio course introduces basic geographical information systems (GIS) and application of landscape ecology principles. Projects examine the role of landscape systems and the formation and reformulation of land development scenarios.

**Prerequisite(s):** LARC 2130 with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World

**LARC 2230. Introduction to Sustainable Site Planning and Design. (4 Hours)**

Addresses fundamental techniques of sustainable site design in the built environment, including earthworks, water, and soils, using current-day storm events. Primary topics include topography, site grading, study models, universal accessibility, and storm water considerations in urban and other built environments. Introduces students to urban tree planting techniques, graphic communications, basic site materials, and construction details.

**Attribute(s):** NUpath Natural/Designed World

**LARC 2240. Sustainable Site Construction and Detailing. (4 Hours)**

Continues LARC 2230. Focuses on construction technologies, methods, and materials for sustainable site elements, including environmental performance infrastructures, circulation systems, and basic site structures. Introduces structural systems for site work via lecture and in-class exercises.

**LARC 2330. Cities, Landscape, and Modern Culture. (4 Hours)**

Seeks to instill basic landscape literacy enabling students to read urban landscapes and recognize different ways of knowing landscapes, including everyday landscapes. Presents key concepts, ethical debates, and iconic works that gave shape to modernism in landscape architecture and urbanism. Focusing on eighteenth-century through mid-twentieth-century projects and designers, examines contextual factors and resulting formal, spatial, organizational, and material characteristics of built works. Using case studies, challenges students to analyze the entangled histories of landscape preservation and urban segregation and to apply theories of environmental ethics and environmental justice to questions about the built environment and the relationship between natural and social systems. Offers students an opportunity to practice formulation of a critical design perspective and landscape interpretation via reading responses, project analysis, written work, podcasts, and StoryMaps.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions, NUpath Writing Intensive

**LARC 2340. Cities, Landscape, and Contemporary Culture. (4 Hours)**

Presents the core themes, social theories, ethical debates, and iconic works that shape the field of contemporary landscape architecture and urban design, particularly in the context of environmental change and climate disruption. Focuses on contemporary projects and designers to examine formal characteristics of built works and contextual factors, including social, political, and economic systems and institutions. Challenges students to apply theories of environmental and climate justice to questions about the built environment and the relationship between natural and social systems. Designed to prepare students to address complex sociocultural and environmental issues through thoughtful inquiry and creative expression. Offers students an opportunity to formulate critical design perspectives via reading responses, project analyses, written work, and podcasts.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions, NUpath Writing Intensive

**LARC 2430. Plants, People, and Landscape Change. (4 Hours)**

Uses the study of New England's plant communities and plant identification as a framework to consider the evolution of the New England landscape from European colonization to the present. Combines field study with lectures and class discussion. Human activity, land use, and settlement patterns all influence the development of landscape, and our cultural history is expressed in the species demographics, land forms, and ecosystem dynamics of our environment.

**Attribute(s):** NUpath Natural/Designed World

**LARC 2440. Planting Design. (4 Hours)**

Combines horticultural and ecological field study with studio design exercises to deliver introductory to advanced planting design techniques. Primary topics include how to design phytoremediation strategies for contaminated sites, seasonal planting considerations, strategic phasing, and maintenance techniques. This is a workshop-based course.

**LARC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at consortium institutions. May be repeated without limit.

**LARC 3170. Landscape Planning and Urbanism Studio. (6 Hours)**

Introduces sustainable landscape planning techniques with an emphasis on adaptive urbanism. Key topics include the designed and managed relationship of cities to their regional ecologies, such as sub/urbanized watersheds and coastal zones, as well as the spatial, material, and programmatic roles of environmental infrastructures in the civic landscape. Particularly emphasizes the market-based integration of recreation, transit, food, housing, and industrial networks with living systems such as urban forests, riparian corridors, managed habitats, and constructed wetlands.

**Prerequisite(s):** LARC 2140 with a minimum grade of D- or ARCH 2140 with a minimum grade of D-

**LARC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at consortium institutions. May be repeated without limit.

**LARC 5110. Advanced Design for Urban Environments Studio. (6 Hours)**

Focuses on ecological, economic, and social resiliency of designed urban environments in response to globalization. Contemporary case studies of urban change provide the basis for design investigation into issues such as the impact of shifting industries on Detroit (deurbanization) or Shenzhen (rapid densification); shifting weather and water patterns in densely populated regions; societal shifts, from generational demographics to political upheavals and militarization/demilitarization of the urban landscape. Emphasizes the integration of interdisciplinary perspectives and advanced design analysis, conceptualization, and visualization skills into development of a global perspective on managing change in the built environment.

**Prerequisite(s):** ARCH 3170 with a minimum grade of D- or LARC 3170 with a minimum grade of D- or SUEN 6110 with a minimum grade of C-

**LARC 5120. Comprehensive Design Studio. (6 Hours)**

Offers students an opportunity to design and develop a site or district including all of its requisite systems. Students draw on their landscape architectural education to produce a design both responsive to specific criteria and prototypical of ways to build sustainable and adaptable public landscapes—often described as “resilience.” Projects are expected to respond to and integrate their contexts (urban, environmental, climatic, and economic); meet spatial, performative, and programmatic requirements and technical demands (materials, implementation and management strategies); and dynamic processes at play within and around the project site.

**Prerequisite(s):** ARCH 3170 with a minimum grade of D- or LARC 3170 with a minimum grade of D- or SUEN 6110 with a minimum grade of C-

**Attribute(s):** NUpath Capstone Experience

**LARC 5210. Landscape Ecology. (4 Hours)**

Introduces fundamental-to-advanced concepts in the field of landscape and urban ecology. Focuses on the landscape-scale spatial structure, temporal patterns, and geographic ranges produced by the intersection of large-scale environmental and human processes. Emphasizes spatial taxonomies (patch, corridor, mosaic, granularity, edge, ecotone) produced across diverse landscape types influenced by human development and landscape dynamics in the built environment (disturbance, fragmentation, accumulation, and succession). Incorporates basic techniques in geographic-information-system software.

**Attribute(s):** NUpath Natural/Designed World

**LARC 5220. Sustainable Landscape Practices. (4 Hours)**

Offers a lecture/workshop/field-based course that builds upon landscape technology skills introduced in LARC 2230 and LARC 2240, with a focus on ecotechnologies operating in the built environment. Core topics include design and implementation metrics, material life-cycle management, funding models, and aesthetic and cultural aspects. Potential topics include green roofs, green walls, bioswales, pervious pavements, constructed wetlands, “complete street” elements, geosensor networks, alternative waste management, water detention and energy generation methods, and living infrastructures for coastal environments.

**Prerequisite(s):** LARC 2240 with a minimum grade of D- or ARCH 2240 with a minimum grade of D- or ARCH 2240 with a minimum grade of C- (Graduate)

**LARC 5310. Urban Landscape Seminar. (4 Hours)**

Offers a discussion-based seminar focusing on case studies of influential works in contemporary landscape, urbanism, and sustainable environmental design. Encourages students to seek interdisciplinary perspectives toward development of critical-thinking skills in relation to forces shaping urban environments in contemporary global culture. A diverse range of material from published design criticism to open-source social media engagement provides basis for discussion and written and oral presentations.

**Attribute(s):** NUpath Interpreting Culture

**LARC 5420. Professional Practice in Landscape Architecture. (4 Hours)**

Offers a lecture- and case-study-based course focusing on strategic planning, business models, organizational structures, logistics, and regulatory paradigms associated with professional practice in landscape architecture. Core topics provide an overview of common technical and business procedures, including RFQs; RFPs; marketing, public relations, and client management; hiring and human resource management; review board/regulatory boards; permitting; and licensure.

**Language - General (LANG)****LANG 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LANG 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LANG 3600. Language Policy. (4 Hours)**

Introduces the field of language policy, i.e., government or other institutional/systemic control of language use. Examines the complexity of policies and how they affect and are affected by historical, political, social, economic, ethnic, and many other factors. Covers issues including the economic efficacy of certain languages, language death, linguistic marginalization, language as a tool of nationalism, language policies and access to basic services, language activism, and language conflict scenarios. Offers students an opportunity to pursue their own case study, analyzing a specific local or global region, using both personal observations and research.

**Attribute(s):** NUpath Societies/Institutions

**LANG 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LANG 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LANG 4992. Directed Study. (1-4 Hours)**

Offers students a way of going beyond work given in the regular curriculum; may also enable students to complete major or minor requirements in certain situations. Priority is given to language majors and to juniors and seniors. May be repeated without limit.

## Latin American and Caribbean Studies (LACS)

**LACS 1220. Latino, Latin American, and Caribbean Studies. (4 Hours)**

Offers an interdisciplinary introduction to Latinos and people of Latin American and Caribbean origin in the United States as well as to the regions of Latin America and the Caribbean. Dispels a series of powerful myths associated with U.S. Latinos and in Latin American and Caribbean society, such as racial inferiority, poverty, machismo, and violence. Introduces the construction of Latino, Latin American, and Caribbean identities as well as the politics, economics, history, and culture.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**LACS 1261. Global Caribbean. (4 Hours)**

Focuses on the culture and history of Caribbean societies in global perspective. Explores Caribbean creativity and resilience across English, French, and Spanish linguistic and political spheres with examples from literature, art, music, food, technology, and performance. Considers the global reach of Caribbean diasporas, highlighting the long local histories of Caribbean communities in Boston. Follows four key themes—indigeneity, blackness, diaspora, and creolization—to understand this unique point of entry for the study of race, gender, and sexuality in the Americas.

**LACS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LACS 2365. Latinx Youthhood in the United States. (4 Hours)**

Surveys topics related to Latinx youthhood. Includes historical, social, and cultural roots of Latinx youthhoods in the United States and how Latinx youthhood has been shaped within colonial, transnational, and global contexts. Emphasizes understanding the ways in which social institutions found in and across the United States and Latin American sending communities have structured Latinx youthhoods in relation to race, gender, class, and citizenship, as well as how Latinx youths have exercised agency to contest the social inequalities resulting from the practices and policies of these social institutions.

**Attribute(s):** NUpath Societies/Institutions

**LACS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LACS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LACS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LACS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Law (for Non-Law School Students) (LW)

**LW 5963. Topics. (1,2 Hours)**

Offers students an opportunity to learn about timely issues, develop new skills, or explore areas of broad interest in an immersive, short-course format. Content and instructors vary by offering. May be repeated three times.

**LW 6101. Introduction to Legal Studies 1: Law and Legal Reasoning. (3 Hours)**

This course will provide students with an introduction to the American legal system and legal reasoning. The course materials will cover rights and obligations created by contracts, fundamental principles of property law, accident law, the regulation of criminal conduct, and the laws associated with business formation and relationships. Students will also complete writing exercises to enable them to synthesize their understanding, and to find and use legal sources in support of their work.

**LW 6102. Introduction to Legal Studies 2. (3 Hours)**

This course builds on LW 6101 with its emphasis on common law by introducing students to statutes and regulations. The setting involves federal administrative agencies governing employment, consumer protection, environment, labor, cyberlaw, intellectual property, and international trade. Exercises and discussions require finding, summarizing, applying and arguing about the applicability of statutes and regulations in concrete situations. The capstone of the course allows students to create a project to illustrate the lessons learned in the course.

**LW 6110. Law of Information and Records. (3 Hours)**

This course will present a comprehensive survey of procedural and evidentiary rules in the context of recordkeeping, document production, due diligence, and investigations. It will include an exploration of rights to privacy, issues of confidentiality and conflicts of interest, contractual and legal liability, evidentiary consequences in administrative and court settings resulting from work-place disputes, and other related areas.

**Prerequisite(s):** LW 6102 with a minimum grade of C-

**LW 6120. Law and Strategy. (3 Hours)**

Introduces students to the implications and impact of law on strategy, with attention to applying legal knowledge and resources to strategic planning and strategy implementation. Uses several examples of readily understood strategies to provide opportunities for students to identify the legal environment, consider the legal rights and requirements implicated by relevant law or regulation (e.g., intellectual property, contracts, administrative law) and their potential impact on management, incorporating law as a resource on the resource based view of the firm. Range of examples include considering law and strategy implementation in multiple contexts. Focuses on developing an appreciation of the legal environment and making effective use of legal resources and lawyers as advisors in strategic management aimed at attaining sustainable competitive advantage over rivals.

**Prerequisite(s):** LW 6400 with a minimum grade of C- or LW 6101 with a minimum grade of C- or LW 6102 with a minimum grade of C-

**LW 6130. Negotiation and Advocacy. (3 Hours)**

Offers students an opportunity to learn core elements of negotiations that are the precursors to any final agreement or resolutions of informal disputes: negotiation planning from opposing sides and counseling; analysis of the bargaining range and opponent's needs; principled concession patterns; problem-solving strategies to avoid deadlock; information bargaining and authority clarification; principles of drafting; settlement; and ethics.

**LW 6140. Data Regulation and Compliance. (3 Hours)**

Covers the challenges facing organizations in building programs that ensure adherence with legal obligations, especially regarding data. Institutions increasingly face a host of regulatory compliance issues. Explores statutes covering a broad range of areas, especially when it involves data protection and privacy.

**Prerequisite(s):** LW 6101 with a minimum grade of C- or LW 6102 with a minimum grade of C- or LW 6400 with a minimum grade of C-

**LW 6150. Law and Organizational Management. (3 Hours)**

Students will learn the rules governing organizations, including corporations, partnerships, governmental organizations, and non-profits. The focus will include relationships within the organizations and powers of members of organizations. In addition, the course will cover employment issues relevant to relationships in organizations. Topics will include rights of workers to be free of discrimination in the workplace, the importance of workplace rules, and policies governing the workplace.

**LW 6155. Legal Foundations of Public Policy. (3 Hours)**

Examines the legal framework for public policymaking at all levels of government. Topics include the role of law within the legislative, executive, and judicial branches of government and the contributions of local, state, and federal governments in crafting and implementing public policy. Explores the history of regulation and the rise of the administrative state. Reviews the landscape of current agency activities, including investigations and the imposition of sanctions. Introduces students to legislative and regulatory drafting processes. Offers students an opportunity to draft model legislation and participate in "notice and comment" rulemaking.

**Prerequisite(s):** LW 6101 with a minimum grade of C- or LW 6102 with a minimum grade of C- or LW 6400 with a minimum grade of C-

**LW 6160. Regulation and Global Business Strategies. (3 Hours)**

This course provides an introduction to the international legal concepts, principles and institutions that define and shape international business relations. Globalization has increased the number of economic interactions across national borders. The globalization of production and consumption takes place in the background of an international monetary system and an international legal infrastructure facilitating and regulating transnational trade, international finance and global intellectual property and investment protection. The course specifically examines case studies of global governance based on codes of practice, certification and other regulatory initiatives.

**Prerequisite(s):** LW 6102 with a minimum grade of C- or LW 6400 with a minimum grade of C-

**LW 6170. Financial Transactions. (3 Hours)**

In this course students will explore various aspects of corporate financial transactions, including vendor and supplier contracts, early stage financing, commercial loans, initial public offerings, mergers, and the sale of assets. Issues involving valuation of assets will be covered, and students will learn basic securities laws related to the transactions covered.

**Prerequisite(s):** LW 6101 with a minimum grade of C- or LW 6102 with a minimum grade of C- or LW 6400 with a minimum grade of C-

**LW 6180. Health Law Survey. (3 Hours)**

Examines legal regulations governing the provision of healthcare services. Topics include access to health insurance and healthcare, healthcare financing, the organization and responsibility of healthcare institutions (especially hospitals), healthcare cost containment policies, public and private insurance programs, and the formulation of health policy. Provides an introductory overview of the major statutes, regulations, and case law related to health law, including an introduction to the Patient Protection and Affordable Care Act, otherwise known as Obamacare.

**Prerequisite(s):** LW 6101 with a minimum grade of C- or LW 6102 with a minimum grade of C- or LW 6400 with a minimum grade of C-

**LW 6181. Healthcare Regulation and Compliance. (3 Hours)**

This course covers major regulatory issues related to the healthcare field, providing an in-depth regulatory overview of health programs. Statutory schemes covered will include HIPAA/HITECH, Stark/fraud and abuse. In addition, students will learn about compliance programs, including compliance operations, and the code of conduct for particular fields.

**Prerequisite(s):** LW 6102 with a minimum grade of C-

**LW 6182. Patient Records, Privacy, and Security. (3 Hours)**

This course explores the ethical and legal obligations respecting patient records, particularly electronic records. In addition to reviewing HIPAA's privacy and security rules, the course will cover professional ethics regarding confidentiality, common law and state protections for confidentiality, GINA, and the HiTech Act.

**Prerequisite(s):** LW 6400 with a minimum grade of C-

**LW 6184. Healthcare Compliance 1. (2 Hours)**

This course is the first of a two-course series that explores the basics of healthcare compliance. This course focuses on the relationships between various participants in the healthcare system and the compliance concerns and programs that exist because of these relationships. At the end of the course students should be able to identify basic compliance issues, consult relevant sources of guidance on achieving compliance, and propose initial resolutions to compliance issues that appropriately weigh business goals and legal risks.

**LW 6190. Introduction to Healthcare Compliance. (1 Hour)**

This course introduces students to the compliance function in health-related settings. Through preparatory work and on-the-ground sessions with faculty, students will have an opportunity to learn about the health care industry and familiarize themselves with vocabulary and concepts that are commonly used in connection with compliance programs.

**LW 6192. Healthcare Compliance 2. (2 Hours)**

This course will provide students with insights into the evolution of healthcare compliance programs and lessons learned by regulators and compliance officers. The course materials will provide an in-depth review of industry best practices for each of the 7 elements of effective compliance programs and risk assessment. Additionally, it will help students build the confidence needed to establish and maintain a business culture of ethics and compliance within a healthcare environment. Students will complete practical research assignments providing them with experiences expected of compliance professionals.

**Prerequisite(s):** LW 6191 with a minimum grade of C-

**LW 6193. Healthcare Compliance Capstone. (1 Hour)**

In this course, students will have the opportunity to deepen their knowledge of healthcare compliance through online exercises, a capstone project, and in-person class sessions that will introduce students to individuals with significant experience in the compliance field.

**LW 6210. Special Topics in Employee Rights and Employer Obligations. (3 Hours)**

Examines the legal relationship between employer and employee. Addresses issues and topics such as discrimination, affirmative action, the Americans with Disabilities Act, sexual harassment, health and safety, AIDS in the workplace, compliance issues, and legal issues related to downsizing and terminations. Today's HR manager works in a highly complex environment with constantly changing laws and legislation that govern employee rights and employer obligations. Course content may vary from term to term.

**Prerequisite(s):** LW 6101 with a minimum grade of C- or LW 6102 with a minimum grade of C- or LW 6400 with a minimum grade of C-

**LW 6211. Antidiscrimination Law. (3 Hours)**

Provides an overview of antidiscrimination laws governing the workplace. Focuses on discrimination based on race and sex, but some attention will also be given to discrimination based on other characteristics, including age, sexual orientation, and disability. In addition to general issues of discrimination, also focuses on the specific topics of retaliation, harassment, and bullying in the workplace.

**Prerequisite(s):** LW 6101 with a minimum grade of C- or LW 6102 with a minimum grade of C- or LW 6400 with a minimum grade of C-

**LW 6212. Wages and Benefits. (3 Hours)**

This course will cover topics related to wage and hour laws (federal and state), ERISA (pensions), health insurance benefits, the Affordable Care Act, and disability insurance.

**Prerequisite(s):** LW 6101 with a minimum grade of C- or LW 6102 with a minimum grade of C- or LW 6400 with a minimum grade of C-

**LW 6230. Intellectual Property Survey. (3 Hours)**

Introduces the classic principles of copyright, patent, trademark, and trade secret law and explores the ways in which those principles are shifting and adapting in response to new technology. In our modern-day "information economy," the law of intellectual property (IP) has taken on enormous importance to both creators and users of creative works. Such IP law is the way we provide legal protection to encourage invention and creativity, by guaranteeing an opportunity for financial return to the originator of novel work.

**Prerequisite(s):** LW 6102 with a minimum grade of C- or LW 6400 with a minimum grade of C-

**LW 6231. Identifying and Securing Intellectual Property Rights. (3 Hours)**

Focuses on intellectual property issues in employment, collaborative environments, and business transactions. Covers common issues for founders and startups, employers, and contractors; including non-compete agreements, crowd-sourcing, and open innovation practices.

**Prerequisite(s):** LW 6101 with a minimum grade of C- or LW 6102 with a minimum grade of C- or LW 6400 with a minimum grade of C-

**LW 6232. Intellectual Property and Media. (3 Hours)**

This course will cover copyrights, trademarks, and unfair competition, with a focus on media, advertising, user-generated content, and other online activities.

**Prerequisite(s):** LW 6101 with a minimum grade of C- or LW 6102 with a minimum grade of C- or LW 6400 with a minimum grade of C-

**LW 6235. Current Issues in Law and Public Policy. (3 Hours)**

Examines the evolving roles of courts, agencies, legislatures, citizen movements, and nonprofit organizations in policymaking through case studies of current debates in law and policy. Explores how businesses and advocacy groups combine the use of legal tools and other activities to achieve policy goals. Considers how law can be used to right past wrongs and how grassroots activities and individual actions can contribute to a fight against injustice. Focuses on a range of policy issues; possible topics include but are not limited to healthcare reform, criminal justice reform, racial justice, reproductive rights, marriage equality, and environmental justice.

**Prerequisite(s):** LW 6101 with a minimum grade of C- or LW 6102 with a minimum grade of C- or LW 6400 with a minimum grade of C-

**LW 6400. Law, Policy and Legal Argument. (4 Hours)**

This course explores the legal levers that drive policy change. Advocates often intend to alter public policy in support of an organization or a cause. But influencing policy requires understanding who sets policy in the first instance. Is the issue governed by federal, state or local law? Are key decision makers elected or appointed? Who is it most important to persuade and what sorts of arguments are likely to convince the key audience? This course will introduce students to the mechanisms of government that drive key policy debates across a wide range of issues, which may include health care, market regulation, environmental policy, housing, education, the internet, privacy, and social policy. Emphasis will be placed on tailoring arguments to different constituencies.

**LW 6407. Introduction to U.S. Law and Legal System. (3 Hours)**

Introduces principles and structures of the legal system in the United States. Covers the U.S. system of government, the U.S. judicial systems at the federal and state levels, U.S. sources of law, common law methodology, and the roles of legal professionals. Designed to familiarize the student with the relevant and governing legal principles that are used in American jurisprudence, including substantive and procedural law. Emphasizes legal terminology in our contemporary legal system.

**LW 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LW 7329. Environmental Law. (3 Hours)**

This course focuses on federal and state environmental laws. Topics include pollution control, waste management, and cleanup of contaminated land and water. The course explores legislative policy and regulatory decisions as well as enforcement issues. We will give attention to questions of environmental justice and to the strategic use of legal tools in working to ensure safe and healthy surroundings for diverse groups of people.

**LW 7333. Family Law. (3 Hours)**

This is a basic course in family law and family policy. The first half of the course explores state regulation of intimate relationships, asking what purposes marriage serves, and looking at the law of incest, polygamy and same sex marriage. The second half of the course examines practical problems in family law: cohabitants' rights; common law marriage; and the many issues relating to divorce, with a particular focus on money and children.

**Prerequisite(s):** LW 6400 with a minimum grade of C-

**LW 7335. Health Law. (3 Hours)**

This course examines the legal regulation of the provision of healthcare services. Much of the focus is on the relationship between law and healthcare policy. Topics include access to health insurance and healthcare, healthcare financing, malpractice liability, the organization and responsibility of healthcare institutions, especially hospitals, the regulation of the quality of care and the formulation of health policy. This course is highly recommended for all students enrolled in the JD/MPH dual degree program, but is open to others as well.

**LW 7358. Social Welfare Law. (3 Hours)**

This course examines American public assistance as a legal institution. After reviewing the historical, sociological and juridical roots of the welfare system, students examine the laws governing major assistance programs, especially eligibility requirements, rules governing grant determination, work and family rules, and procedural rights. Primary emphasis is on statutory and regulatory construction. The course explores methods by which lawyers can deal with the system: advocacy in the administrative process, litigation, legislative reform and representation of recipient organizations.

**LW 7369. Intellectual Property. (3 Hours)**

In our modern day information economy, the law of intellectual property has taken on enormous importance to both creators and users of intellectual creations. Introduces students to the classic principles of copyright, patent, trademark, and trade secret law and explores the ways in which those principles are shifting and adapting in response to new technology.

**Prerequisite(s):** LW 6400 with a minimum grade of C-

**LW 7394. Land Use. (3 Hours)**

A survey of legal doctrines, techniques and institutions relating to regulation of the use of real property. Topics covered include constitutional questions of takings by public agencies, the scope of the police power as it affects land use and the basic techniques of zoning and subdivision control. Students study, among other issues, recent cases on exclusion of low income housing, current techniques to encourage housing development (inclusionary or "linkage" regulations) and First Amendment questions arising from land use controls.

**Prerequisite(s):** LW 6400 (may be taken concurrently) with a minimum grade of C-

**LW 7424. Labor Law 1. (4 Hours)**

A general introduction to the law of labor relations through an examination of the National Labor Relations Act and leading cases, in conjunction with historical, social and economic materials. Topics include organization, union recognition, unfair labor practices and collective bargaining.

**LW 7469. Disability Law. (3 Hours)**

This course explores how the law treats individuals with disabilities. We will analyze what is meant by the term "disability" and consider constitutional review of state actions discriminating against individuals with disabilities. Particular attention will be given to the rights and obligations created by the Rehabilitation Act, the Americans with Disabilities Act and the Individuals with Disabilities Education Act. The rights of individuals with disabilities to be educated, work, receive healthcare, and enjoy public accommodations will be considered in depth. This course is designed for students wishing to represent individuals with disabilities as well as students who may represent employers and public accommodations.

**LW 7475. First Amendment. (3 Hours)**

This course examines several rights protected by the First Amendment to the Constitution. The focus is on the principles and processes developed by the judiciary to protect various forms of speech, expression and association. The course does NOT deal with the free exercise of religion or the establishment clause. The course also focuses on integrating doctrine with the core values of the First Amendment as well as emphasizing the need for students to develop their own preferred approach to protecting free expression. The course does not, except tangentially, deal with other parts of the Bill of Rights.

**Prerequisite(s):** LW 6400 with a minimum grade of C-

**LW 7488. Sexuality, Gender and the Law. (3 Hours)**

This course uses case law and theory to address doctrinal problems and justice concerns associated with gender and sexuality. The syllabus is organized around notions such as privacy, identity and consent, all of which are conceptual pillars upon which arguments in the domain of sexuality and gender typically rely. Doctrinal topics include same-sex marriage, sodomy, sexual harassment, discrimination, among others, but the course is not a doctrinal survey; it is a critical inquiry into key concepts that cut across doctrinal areas. Students should expect to write a paper and share some of what they have learned with the class.

**LW 7491. International Human Rights and the Global Economy. (3 Hours)**

This course surveys the international human rights legal system. It includes the promotion and protection of economic, social, and cultural rights (such as rights to health, food, water, and education) and civil and political rights (such as equality and non-discrimination, the right to human security, the prohibition on torture, and rights to religious and cultural expression). We begin by examining the history and theoretical origins of human rights law. We then engage the legal framework under international and regional human rights treaties and interpretations of them by international, regional and domestic courts and other actors. We examine international, regional and domestic mechanisms for monitoring compliance. Finally, we grapple with tensions among cultural and religious imperatives and traditional human rights.

**LW 7494. Bioethics and the Law. (3 Hours)**

Explores the intersection of law, medicine, and ethics in diverse contexts that call for the evaluation of policies and practices implicating individual or public health. Topics may include but are not limited to end-of-life care, reproductive technologies, vaccines and the management of public health emergencies, professional and research ethics, confidentiality in health information, and equitable access to health care.

**LW 7512. Problems in Public Health Law. (3 Hours)**

Explores the rationales for using law to protect and preserve the public's health, the legal tools that may be used to achieve that end, and the conflicts and problems that may result from legal interventions. Topics discussed include the use of law to reduce the spread of HIV and other infectious diseases, control of tobacco and other hazardous products, bioterrorism, and the threats to civil liberties and minority groups engendered by all such legal efforts. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** LW 6400 with a minimum grade of C-

**LW 7514. Natural Resources Law. (3 Hours)**

This course addresses legal requirements and institutions dealing with animal and plant species, biological resources, habitats, and ecosystems. Major themes include biological diversity, endangered and threatened species, public and private rights in migratory resources, public trust doctrine, the allocation of power among federal, state, and local governments, and the roles of administrative agencies in ecosystem management. The course provides opportunities to explore specific topics of interest such as environmental ethics, wetlands protection, fisheries law, Native American hunting rights and fishing rights, and management of national parks, forests, and grazing lands.

**LW 7525. Law and Economic Development. (3 Hours)**

Examines the prevailing economic theories of and strategies for economic development since World War II and the legal and institutional frameworks devised to implement these strategies. Questions we will explore will include: What kinds of legal and institutional arrangements best facilitate economic growth? How does law structure and shape markets? What is development; and how can it best be measured? Can legal instruments be used effectively to address underdevelopment in a structural way? While the focus is on development in the so-called "developing world"; we will also explore some strategies for addressing development in a local community context. Course concludes by applying what we have learned to address several development case studies posing particular problems in particular regions and contexts.

**LW 7526. Juvenile Courts: Delinquency, Abuse, Neglect. (3 Hours)**

Examines the evolution of the juvenile court system and issues related to juvenile justice and child welfare. Includes the study of procedural and substantive principles related to court subject matter, including delinquency, youthful offender, status offense, and abuse and neglect jurisdiction. In attempting to focus on connecting theory to practice, the class employs a contextual lens by considering the larger communities and systems that affect children, families, and public safety. This entails consideration of the consequences of decisions and policies in and out of courtrooms. Related topics include adolescent development; racial, ethnic, and gender equity; access to educational and mental health services; and public health.

**LW 7530. Education Law. (3 Hours)**

Surveys current issues in U.S. education law. Topics may include high-stakes testing, school choice and the charter school movement, resegregation, special education, the school-to-prison pipeline, and school funding.

**LW 7539. Employment Law—Job Security and Rights. (3 Hours)**

This course surveys legal and policy issues concerning job security, focusing primarily on law governing the termination of private sector employment. Students develop an understanding of the history and scope of the underlying employment-at-will doctrine and the primary ways in which the at-will doctrine has been modified through common law and statute.

**Prerequisite(s):** LW 6400 with a minimum grade of C-

**LW 7550. Refugee and Asylum Law. (3 Hours)**

This course will explore the law of asylum and refugees. The primary focus will be on U.S. law as it has evolved since passage of the Refugee Act of 1980. This will include legislation and case law—both administrative and federal court cases. It will also look at relevant international law and standards utilized in other countries by way of comparison with U.S. Law. We will also examine the process of asylum adjudications to analyze issues of due process, credibility, cross cultural communication and integrity of the various legal procedures. We will explore new and emerging theories of asylum eligibility and policy developments which impact asylum seekers in the United States.

**Prerequisite(s):** LW 6400 (may be taken concurrently) with a minimum grade of C-

**LW 7588. Reproductive Rights and Health. (3 Hours)**

Examines how sexual and reproductive health laws impede or increase access to sexual and reproductive healthcare and shape how we understand what constitutes sexual and reproductive health. Attention is paid to understanding legal doctrine, public health research, and critically assessing issues arising from sexual and reproductive health law. Draws on various tools of analysis including critical race theory, critical legal theory, human rights, and a range of public health methods. Topics covered include, amongst others, sexual and reproductive health law as it pertains to abortion, sexuality, pregnancy, marriage, healthcare in prisons, immigrants, HIV/AIDS, and sex education.

**Prerequisite(s):** LW 6400 with a minimum grade of C-

**LW 7597. Civil Rights and Restorative Justice Clinic. (1-6 Hours)**

The CRRJ (Civil Rights and Restorative Justice) Clinic engages students in legal research, litigation and legislative initiatives relating to anti-civil rights violence in the United States. CRRJ clinic students assist law enforcement agencies considering criminal investigation and pursue civil litigation against government entities. One of CRRJ's projects, Reconstructing Cases of Racial Violence, involves researching cases where criminal prosecution may not be an option. Students reconstruct legal proceedings and conduct factual investigations. The project focuses on practical legal research skills and helps students integrate the law of torts, civil procedure, federal courts, criminal law, and constitutional law. Faculty will provide individual supervision of each student.

**LW 7606. Drug Law and Policy. (3 Hours)**

The field of Drug Law is vast, spanning the discovery, manufacture, distribution, and consumption of chemical agents designed to alter the human condition. This course focuses on three domains of the broader subject: the evolution and current state of the Federal Food, Drug, and Cosmetic Act; the architecture of the drug regulation system in the U.S., including the distinct space occupied by the Food and Drug Administration, the Department of Agriculture, and the Drug Enforcement Agency; and the role of regulation and tort litigation in harmonizing drug policy with science. Designed around legal and policy case studies, this course is intended for students expecting to become involved in clinical practice involving pharmaceuticals as well those generally interested in the interplay of law and public health.

**Prerequisite(s):** LW 6400 with a minimum grade of C

**LW 7612. Wrongful Convictions and Post-Conviction Remedies. (3 Hours)**

The emergence of DNA testing has not only assisted law enforcement in solving crimes, but it has also helped to expose a problem that many observers of the criminal justice system have long suspected: that a number of actually innocent prisoners have been convicted in the United States. Given that biological evidence suitable for post-conviction DNA testing is available in only a smattering of cases, the exonerations generated by DNA represent only the tip of the innocence iceberg, so to speak. This class will explore (1) the primary factors that contribute to the phenomenon of wrongful convictions, (2) the state and federal procedures through which post-conviction claims are litigated and (3) potential reforms to protect against the conviction of the innocent.

**Prerequisite(s):** LW 6400 with a minimum grade of C-

**LW 7620. Human Behavior, Legal Doctrine, and Policy Design. (3 Hours)**

This course will compare accounts of human behavior, including the Utilitarian/Law and Economics view of man as a rational calculator of his self-interest, with classical and contemporary alternatives to that description, including Behavioral Economics. We will evaluate the reasons for doubting or crediting these competing accounts, and will then consider their implications for determining appropriate legal doctrines and regulatory approaches. For example, we may consider whether the views of human behavior which shape consumer protection case law and the Supreme Court's commercial speech doctrine are justified, and whether – and in what circumstances – regulations are appropriate which seek to help people by prescribing, proscribing, or "nudging" their behavior. Students are expected to participate in class and write a research paper which may satisfy the writing requirement.

**LW 7634. Energy Law and Policy. (3 Hours)**

Climate change and carbon emissions are the most important issues shaping energy law and policy in the United States today. This course will provide an introduction to U.S. energy law and policy in that context and will be organized around the regulated electricity sector which alone produces about 40% of all U.S. greenhouse gas emissions. We will explore the dynamics of natural monopoly markets, public utilities and their regulation, and the interplay of state and federal power in the energy space. We examine coal, natural gas, nuclear power, hydropower, renewables, storage, and efficiency for their impacts and potential as electrical energy sources in a carbon-constrained world. We conclude by investigating the legal potential to proactively foster and sustain a transition to a carbon-sustainable energy economy.

**Prerequisite(s):** LW 6400 with a minimum grade of C-

**LW 7635. Laboratory Seminar in Applied and Critical Legal Design. (4 Hours)**

Offers students the opportunity to critically engage with design methods and principles in the development of new solutions and ideas for our legal systems, institutions, and problems. Examines methodologies derived from the fields of product, service, and critical design and emphasizes hands-on student engagement with structured creative processes, field observations, prototyping or other methods derived from a diversity of creative disciplines. Students apply these methodologies and skills in the formulation of a response to a timely design question. Students' exploration of critical design fosters a vision of a future world where everyone is empowered to use the law.

**LW 7651. Human Rights in the United States. (3 Hours)**

Explores the role of international human rights frameworks and strategies in social justice lawyering in the United States. On a range of issues, lawyers are bringing human rights home. They are using human rights mechanisms of the United Nations and Inter-American Human Rights system, drawing on international human rights and comparative foreign law in litigation before U.S. courts, and engaging in other human rights-based advocacy such as documentation, organizing, and human rights education. Advocates find that a human rights approach provides important strategic leverage and highlights the interdependence of economic, social, cultural, civil, and political rights. Uses skills exercises, assignments and real-world problems to develop practical skills to address policies on local, state and national levels, and to support social movements.

**LW 7664. Law and Inequality. (3,4 Hours)**

Explores inequality from a range of disciplinary perspectives and the difference that can make in a variety of legal, social, and economic contexts. Elaborates methodologies for mapping ways diverse legal regimes and concepts contribute to the production, recognition, reinforcement, and maintenance of hierarchies of privilege and disadvantage between individuals, groups, localities, regions, and nations. Identifies key legal drivers in the production of inequities and explores how they shift bargaining power, redistribute resources, or otherwise ameliorate inequities or their adverse consequences. Students research a circumstance of inequality and develop a legal map to engage it. With permission of instructor, students may register for an additional credit by completing a substantial paper or equivalent writing project (in addition to other course requirements) as required by the instructor.

**LW 7666. Human Rights, the Environment, Development and Community Resilience. (3 Hours)**

This course explores the interlinkages between human rights and the environment within the context of how unsustainable development, especially by businesses, is driving environmental degradation and global human rights violations. We will appraise how communities are responding with innovative lawyering utilizing emerging jurisprudence in comparative law and judicial, quasi-judicial, and non-judicial grievance mechanisms, with special attention to African examples. The course will emphasize practical approaches to environmental protection using human rights instruments. The power of corporations and financial institutions, the ways in which corporate activities often connect to abuses of human rights and the environment, and legal advances in the regulation of transnational corporate activity will be explored while also discussing corporate accountability, the global justice movement, and strategies being used to address these trends.

**LW 7667. Law and Ethics of Advocacy. (3 Hours)**

What limits are there on actions aimed at influencing public officials or public opinion? What limits should there be? Clearly, it is unlawful to offer a bribe to a public official to produce a desirable outcome. But what constitutes a bribe? Can a lobbyist send a wedding gift to a favorite legislator? Are the rules different when advocacy efforts reach beyond United States borders? Are there limits on what an advocate can say to promote a product or service? Where is the line between conduct that is legally permissible and conduct that is not? To what extent are legal boundaries and ethical boundaries aligned? This course will explore the ethical and legal issues that arise in connection with advocacy.

**LW 7669. Law and Technology. (3 Hours)**

Examines law and technology as both processes and artifacts endemic to human groups, who have been toolmakers and lawmakers since human history has been recorded. Yet, in recent times, development of technological things has outpaced development in the law, bringing about what we might describe as new "design challenges" within the law. Considers several disputes around ownership and property, and safety and risk, and offers students a conceptual framework from the social study of science and technology by which to understand technology and the law. Focuses on the regulation of "digital labor" and algorithmically convened labor markets, such as Uber.

**Prerequisite(s):** LW 6400 with a minimum grade of C-

**LW 7687. First Amendment Seminar: The Religion Clauses. (3 Hours)**

Examines the religion clauses of the First Amendment and related statutory regimes, emphasizing the U.S. Supreme Court's free exercise and establishment clause jurisprudence. Evaluates individual and institutional claims of religious liberty. Explores the implications of government funding of religious institutions and activities. Discusses government expression or endorsement of religious messages.

**LW 7688. Social Policy and the Tax Code. (3 Hours)**

Offers students an opportunity to obtain an understanding of how tax laws shape and are a major driver of social policy. Emphasizes the redistributive qualities and potentials of such policies and examines their design, implementation, and administration. Draws on legal methodologies as well as those from allied social sciences. May include such topics as healthcare, housing, and income support.

**LW 7692. Collaborative Businesses. (2-3 Hours)**

Examines the fundamental principles, structures, finance, management and governance associated with collaborative businesses (with a focus on co-operatives).

**LW 7695. Drug and Device Innovation: Law and Policy. (3 Hours)**

Introduces students to innovation law and policy in the context of drugs and devices regulated by the Food Drug Administration (FDA). Surveys the suite of incentives policymakers can use, purposefully or inadvertently, to shape drug and device development. Combines analysis from law, economics, and health policy.

**LW 7697. Issues in Human Rights and Humanitarian Law. (3 Hours)**

Examines cutting-edge issues in human rights and humanitarian law through presentations by leading scholars in the field and in-depth seminar discussions. Emphasizes both core concepts and sophisticated critiques of human rights in a range of areas including conflict and war, accountability and justice, race and racism, and colonialism and inequality.

**LW 7699. Efforts in Criminal Law Minimalism. (3 Hours)**

Examines several recent efforts in criminal legal reform. Introduces the recent abolition movement, emphasizing an understanding of critiques of policing and mass incarceration. Presents several efforts to change the criminal system including efforts to halt racialized policing; remove police from particular settings; reform pretrial detention; implement change within the trial process, such as Batson reform; and reform sentencing. These reform efforts include legislative reform, judicial challenges, community organization, and public media campaigns. Offers students an opportunity to develop their knowledge of advanced criminal procedure in the context of ongoing efforts to change a deeply flawed system.

**LW 7700. Intellectual Property and Social Justice. (3 Hours)**

Examines the social justice aspects of different forms of intellectual property. Combines a study of contemporary issues in law and society with appropriate readings that provide theoretical, doctrinal, and social context for the use of and resistance to intellectual property.

**Prerequisite(s):** LW 7369 (may be taken concurrently) with a minimum grade of C- or LW 7501 (may be taken concurrently) with a minimum grade of C-

**LW 7703. Spatial Justice, Legal Ethnography, and the Lawscape. (2 Hours)**

Surveys the intersections of law, space, and society through the lenses of spatial justice and legal ethnography. Focuses on critical analysis of the concepts of spatial justice, alongside contemporary perspectives on reparative spatial futures and intersectionality. Examines the lawscape; the role of the body; and the atmosphere in shaping how legal frameworks and spatial arrangements influence social justice issues, power dynamics, and access to resources. Offers students an opportunity to engage with creative methods in presenting their site-based ethnographic research, integrating experiential with legal analysis. Designed to prepare students to advocate for fair and inclusive policies in areas such as housing disparities, environmental justice, and urban planning.

**LW 7705. Law and Global Technology. (3 Hours)**

Investigates the interaction between law and technology through an infrastructural lens. Provides technical introductions to digital infrastructures—including ad-tech, the internet, and AI—and discusses the legal issues surrounding those infrastructures. Explores the difficulties in applying long-standing regulatory theories to emerging technology through the study of recent legislation, litigation, and scholarship. No prior technical experience is required or expected.

**LW 7706. State Constitutions and the Protection of Individual Rights. (3 Hours)**

Introduces students to the unique role that state constitutions play in our federal system. Surveys the historic development of state constitutions, and the connections between state constitutions and national constitutional developments. Emphasizes the role of state constitutions in protecting individual rights.

**LW 7976. Directed Study. (1-6 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated two times for a maximum of six semester hours.

**LW 7983. Special Topics in Law. (1-8 Hours)**

Covers special topics in law. May be repeated up to nine times for a maximum of 30 semester hours.

## Law (LAW)

### LAW 3101. Introduction to Legal Studies 1: Law and Legal Reasoning. (4 Hours)

Introduces the American legal system and legal reasoning. Covers rights and obligations created by contracts, fundamental principles of property law, accident law, the regulation of criminal conduct, and the laws associated with business formation and relationships. Requires students to complete writing exercises to enable them to synthesize their understanding and to find and use legal sources in support of their work.

### LAW 3102. Introduction to Legal Studies 2: Statutes and Regulations. (4 Hours)

Builds on LAW 3101 by introducing statutes and regulations. Covers federal administrative agencies governing employment, consumer protection, environment, labor, cyberlaw, intellectual property, and international trade. Uses exercises and discussions to require students to find, summarize, apply, and argue about the applicability of statutes and regulations in concrete situations. The capstone of the course offers students an opportunity to create a project to illustrate the lessons learned in the course.

### LAW 3120. Introduction to Law and Strategy. (4 Hours)

Introduces the implications and impact of law on business strategy. Emphasizes applying legal knowledge and resources to strategic planning and strategy implementation. Uses several examples of strategies to provide opportunities for students to identify the legal environment and to consider the legal rights and requirements implicated by relevant law or regulation. Examples consider law and strategy implementation in multiple contexts. Focuses on developing an appreciation of the legal environment and making effective use of legal resources and lawyers as advisors in strategic management.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S); LAW 3101 with a minimum grade of C; LAW 3102 with a minimum grade of C

### LAW 3130. Introduction to Negotiation and Advocacy. (4 Hours)

Introduces core principles and practices of negotiations: negotiation planning from opposing sides and counseling, analysis of the bargaining range and opponent's needs, principled concession patterns, problem-solving strategies to avoid deadlock, information bargaining and authority clarification, principles of drafting, settlement, and ethics.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S); LAW 3101 with a minimum grade of C; LAW 3102 with a minimum grade of C

### LAW 3140. Data Regulation and Compliance. (4 Hours)

Builds on LAW 3102. Covers the challenges facing organizations in building programs that ensure adherence with legal obligations, especially regarding data. Explores statutes covering a broad range of areas, especially involving data protection and privacy.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S); LAW 3101 with a minimum grade of C; LAW 3102 with a minimum grade of C

### LAW 3150. Introduction to Law and Organizational Management. (3 Hours)

Introduces the rules governing organizations, including corporations, partnerships, governmental organizations, and nonprofits. Emphasizes relationships within organizations and powers of members of organizations. Covers employment issues relevant to relationships in organizations. Topics include rights of workers to be free of discrimination in the workplace, the importance of workplace rules, and policies governing the workplace.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S); LAW 3101 with a minimum grade of C; LAW 3102 with a minimum grade of C

### LAW 3160. Introduction to International Regulations and Business Strategies. (3 Hours)

Introduces the international legal concepts, principles, and institutions that define and shape international business relations. Explores international monetary systems and legal infrastructures facilitating and regulating transnational trade, international finance and global intellectual property, and investment protection. Examines case studies of global governance based on codes of practice, certification, and other regulatory initiatives.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S); LAW 3101 with a minimum grade of C; LAW 3102 with a minimum grade of C

**LAW 3170. Introduction to Financial Transactions. (3 Hours)**

Explores various legal aspects of corporate financial transactions, including vendor and supplier contracts, early stage financing, commercial loans, initial public offerings, mergers, and the sale of assets. Covers issues involving valuation of assets. Offers students an opportunity to learn basic securities laws related to the transactions covered.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S ); LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C

**LAW 3181. Introduction to Healthcare Compliance. (3 Hours)**

Explores regulatory issues related to the healthcare field including issues in the areas of HIPAA, fraud, and abuse. Topics include Medicare, corporate organizations, and integrated delivery systems. Focuses on compliance programs, including compliance operations.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S ); LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C

**LAW 3182. Introduction to Patient Records, Privacy, Security. (3 Hours)**

Introduces ethical and legal obligations applicable to patient records. Reviews HIPAA's privacy and security rules. Covers professional ethics related to confidentiality, common law and state protections for confidentiality, 42 CFR Part 2, and the Genetic Information Nondiscrimination Act.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S ); LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C

**LAW 3210. Introduction to Employee Rights and Employer Obligations. (3 Hours)**

Examines the legal relationship between employer and employee. Addresses discrimination, affirmative action, the Americans with Disabilities Act, sexual harassment, health and safety, AIDS in the workplace, compliance issues, and legal issues related to downsizing and terminations. Specific issues and topics covered may vary from term to term.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S ); LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C

**LAW 3211. Introduction to Antidiscrimination Law. (3 Hours)**

Introduces antidiscrimination laws governing the workplace. Focuses on discrimination based on race and sex but also considers characteristics such as age, sexual orientation, and disability. Examines topics such as retaliation, harassment, and bullying in the workplace.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S ); LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C

**LAW 3212. Introduction to Wages and Benefits. (3 Hours)**

Introduces laws and regulations that determine the rights and duties of employees and employers as they relate to wages and employment benefits. Topics may include wage and hour laws, the Employee Retirement Income Security Act (pensions), job-protected leaves, health insurance benefits, the Affordable Care Act, disability insurance, and unemployment benefits. Focuses primarily on federal law but also discusses state law and rights expanded under a union collective bargaining agreement.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S ); LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C

**LAW 3232. Introduction to Intellectual Property and Media. (3 Hours)**

Introduces copyrights, trademarks, and unfair competition. Focuses on media, advertising, user-generated content, and other online activities.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S ); LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C

**LAW 3235. Issues in Law and Public Policy. (4 Hours)**

Illustrates the roles of courts, agencies, legislatures, citizen movements, and nonprofit organizations in law and policy through case studies. Explores how businesses and advocacy groups use legal tools and other approaches to achieve their goals. Considers how law can be used to right past wrongs and how grassroots activities can fight injustice. Focuses on a range of issues.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S); LAW 3101 with a minimum grade of C; LAW 3102 with a minimum grade of C

**LAW 3236. Introduction to Contract Drafting. (3 Hours)**

Introduces the drafting of contracts. Dissects and examines contracts encountered in business relationships. Evaluates, explores, and interprets drafting style, techniques, and decisions in varied contexts. Class exercises are designed to help students draft and analyze contracts of increasing complexity.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S); LAW 3101 with a minimum grade of C; LAW 3102 with a minimum grade of C

**LAW 3238. Introduction to Global Regulation of Artificial Intelligence. (3 Hours)**

Examines regulation of artificial intelligence technologies on a global scale by introducing the legal, ethical, and policy challenges posed by AI's rapid advancement. Through readings, case studies, debates, and interactive discussions, considers various regulatory approaches, international collaborations, geopolitical significances, and potential future directions of AI governance.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S); LAW 3101 with a minimum grade of C; LAW 3102 with a minimum grade of C

**LAW 3239. Introduction to Sports Law, Business, and Society. (3 Hours)**

Examines the legal, business, and social structures that intersect with professional, collegiate, and amateur sports in the United States. Explores intellectual property law, labor law, antitrust law, employment law, agency law, constitutional law, broadcasting law, and private association law in relationship to the sports industry. Covers topics such as the business applications of the sports industry and the industry's relationship to antidiscrimination laws concerning race, sex, national origin, and other protected classes. Debates underlying principles to rethink the ethical boundaries that surround the sports industry.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S); LAW 3101 with a minimum grade of C; LAW 3102 with a minimum grade of C

**LAW 3320. Introduction to Intellectual Property. (3 Hours)**

Introduces the classic principles of copyright, patent, trademark, and trade secret law. Explores the ways in which those principles are shifting and adapting in response to new technology. Studies the law of intellectual property from the perspectives of creators and users.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S); LAW 3101 with a minimum grade of C; LAW 3102 with a minimum grade of C

**LAW 3321. Introduction to Identifying and Securing Intellectual Property Rights. (3 Hours)**

Introduces intellectual property issues in employment, collaborative environments, and business transactions. Covers common issues for founders and startups, employers, and contractors, including noncompete agreements, crowdsourcing, and open innovation practices.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S); LAW 3101 with a minimum grade of C; LAW 3102 with a minimum grade of C

**LAW 3800. Reflections on Law. (1 Hour)**

Offers students an opportunity to reflect on legal issues discussed in a law course in which they are concurrently enrolled. Through activities such as written reflections, discussions, and presentations, students closely examine legal topics and consider their broader implications. Explores how law shapes endeavors in students' areas of interest. May be repeated once.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S); LAW 3101 with a minimum grade of C; LAW 3102 with a minimum grade of C

**LAW 3801. Writing on Legal Issues. (1 Hour)**

Offers students an opportunity to further explore legal issues discussed in a law course in which they are concurrently enrolled. Writing assignments are designed to enable students to learn more about topics in their areas of interest while also honing communication skills. May be repeated once.

**Prerequisite(s):** (BUSN 4945 with a minimum grade of C or COOP 3945 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S or EEBA 2945 with a minimum grade of S or EEBA 2948 with a minimum grade of S ); LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C

**LAW 4335. Health Law and Policy. (4 Hours)**

Examines the legal regulation of the provision of healthcare services. Focuses on the relationship between law and healthcare policy. Topics include access to health insurance and healthcare; healthcare financing; malpractice liability; the organization and responsibility of healthcare institutions, especially hospitals; the regulation of the quality of care; and the formulation of health policy.

**Prerequisite(s):** (COOP 3945 with a minimum grade of S or COOP 3948 with a minimum grade of S ); (LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C )

**LAW 4369. Advanced Intellectual Property. (3 Hours)**

Explores the classic principles of copyright, patent, trademark, and trade secret law and how those principles are shifting and adapting in response to new technology. In our modern day "information economy," the law of intellectual property has taken on enormous importance to both creators and users of intellectual creations.

**Prerequisite(s):** (COOP 3945 with a minimum grade of S or COOP 3948 with a minimum grade of S ); (LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C )

**LAW 4501. Patent Law and Practice. (3 Hours)**

Offers an in-depth review of patent law and practice. Covers the administrative process for obtaining patents, including the requirements for patentability, enforcement of patent rights, and the defense of patent infringement suits. Presents the content of the course in a simple, nontechnical manner so that students of all disciplines have an opportunity to learn and understand the concepts.

**Prerequisite(s):** (COOP 3945 with a minimum grade of S or COOP 3948 with a minimum grade of S ); (LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C )

**LAW 4525. Law and Economic Development. (3 Hours)**

Examines prevailing theories of and strategies for economic development and the legal and institutional frameworks devised to implement these strategies. Considers what kinds of legal and institutional arrangements best facilitate economic growth, how law structures and shapes markets, what "development" is and how it can best be measured, and whether legal instruments can be used effectively to address underdevelopment in a structural way. Focuses on development in the so-called developing world while exploring some strategies for addressing development in a local community context. Analyzes several development case studies posing particular problems in specific regions and contexts.

**Prerequisite(s):** (COOP 3945 with a minimum grade of S or COOP 3948 with a minimum grade of S ); (LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C )

**LAW 4600. Issues in Health Law and Policy. (3 Hours)**

Examines recent debates in health law and policy by discussing current events; legislation and/or regulation; and scholarly articles and commentaries in law, medicine, and other related disciplines. Topics depend in part on student interest but may include healthcare financing reform; public health; health disparities; reproductive care; health information; health technologies; artificial intelligence; malpractice liability reform; pharmaceutical pricing and promotion; and other issues related to healthcare access, quality, and financing.

**Prerequisite(s):** (COOP 3945 with a minimum grade of S or COOP 3948 with a minimum grade of S ); (LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C )

**LAW 4635. Legal Empowerment and Applied Design. (4 Hours)**

Offers students an opportunity to critically engage with design methods and principles in the development of legal solutions in support of a future world where everyone is empowered to use the law. Examines methodologies derived from the fields of product, service, and critical design in a seminar setting. Emphasizes hands-on student engagement with structured creative processes, including field observations and prototyping. Students apply these methodologies and skills in the formulation of a response to a timely design question.

**Prerequisite(s):** (COOP 3945 with a minimum grade of S or COOP 3948 with a minimum grade of S ); (LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C )

**LAW 4640. Issues in Information Security Law. (3 Hours)**

Examines the state of the legal art in information security law—what is known in DC policy circles as cybersecurity. Discusses why data breaches continue to run rampant, what duties of data care and code safety are owed to consumers, and how various government agencies are tackling the consumer protection and national security issues implicated by vulnerable computer code.

**Prerequisite(s):** (COOP 3945 with a minimum grade of S or COOP 3948 with a minimum grade of S ); (LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C )

**LAW 4664. Law and Inequality. (3 Hours)**

Explores inequality from a range of disciplinary perspectives and the difference it can make in a variety of legal, social, and economic contexts. Elaborates methodologies for mapping ways diverse legal regimes and concepts contribute to the production, recognition, reinforcement, and maintenance of hierarchies of privilege and disadvantage between individuals, groups, localities, regions, and nations. Identifies key legal drivers in the production of inequities and explores how they shift bargaining power, redistribute resources, or otherwise ameliorate inequities or their adverse consequences.

**Prerequisite(s):** (COOP 3945 with a minimum grade of S or COOP 3948 with a minimum grade of S ); (LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C )

**LAW 4700. Intellectual Property and Social Justice. (3 Hours)**

Examines the social justice aspects of different forms of intellectual property. Combines a study of contemporary issues in law and society with appropriate readings that provide theoretical, doctrinal, and social context for the use of and resistance to intellectual property.

**Prerequisite(s):** (COOP 3945 with a minimum grade of S or COOP 3948 with a minimum grade of S ); (LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C ); (LAW 4369 (may be taken concurrently) with a minimum grade of C or LAW 4501 (may be taken concurrently) with a minimum grade of C )

**LAW 4983. Special Topics in Law. (1-4 Hours)**

Covers special topics in law. May be repeated twice for a maximum of 6 semester hours.

**Prerequisite(s):** (COOP 3945 with a minimum grade of S or COOP 3948 with a minimum grade of S ); (LAW 3101 with a minimum grade of C ; LAW 3102 with a minimum grade of C )

**LAW 6100. Civil Procedure. (5 Hours)**

Introduces students to the procedural rules that courts in the United States use to handle noncriminal disputes. Designed to provide a working knowledge of the Federal Rules of Civil Procedure and typical state rules, along with an introduction to federalism, statutory analysis, advocacy, and methods of dispute resolution. Examines procedure within its historical context.

**LAW 6101. Constitutional Law. (4 Hours)**

Studies the techniques of constitutional interpretation and some of the principal themes of constitutional law: federalism, separation of powers, public vs. private spheres, equality theory and rights analysis. The first part of the course is about the powers of government. The second part is an in-depth analysis of the 14th Amendment.

**Attribute(s):** NUpath Societies/Institutions

**LAW 6102. Contracts. (5 Hours)**

This course examines the legal concepts governing consensual and promissory relationships, with emphasis on the historical development and institutional implementation of contract theory, its relationship and continuing adaptation to the needs and practice of commerce, and its serviceability in a variety of non-commercial contexts. Topics covered include contract formation, the doctrine of consideration, remedies for breach of contracts, modification of contract rights resulting from such factors as fraud, mistake and unforeseen circumstances, and the modern adaptation of contract law to consumer problems. This course also introduces students to the analysis of a complex statute: the Uniform Commercial Code.

**LAW 6103. Criminal Justice. (4 Hours)**

In this course, students are introduced to the fundamental principles that guide the development, interpretation and analysis of the law of crimes. They are also exposed to the statutory texts—primarily the Model Penal Code, but also state statutes. In addition, students are introduced to the rules and principles used to apportion blame and responsibility in the criminal justice system. Finally, students examine the limits and potential of law as an instrument of social control.

**LAW 6105. Property. (4 Hours)**

This course covers the major doctrines in American property law, including trespass, servitudes, estates in land and future interests, landlord-tenant relationships, nuisance, and takings. Students are introduced to rules, policies, and current controversies.

**LAW 6106. Torts. (4 Hours)**

This course introduces students to theories of liability and the primary doctrines limiting liability, which are studied both doctrinally and in historical and social context. The course includes a brief consideration of civil remedies for intentional harms, but mainly focuses on the problem of accidental injury to persons and property. It also provides an introductory look at alternative systems for controlling risk and allocating the cost of accidents in advanced industrial societies.

**LAW 6160. Legal Skills in Social Context: Foundations of Social Justice Project. (2 Hours)**

Introduces concepts of social justice lawyering, including critical theories of law, project management, and teamwork. Develops students' ability to think critically about the historical context of law, the impact of law on vulnerable communities, and the role of law and lawyers in advancing justice. Students use their legal research and writing skills in a social justice context by working in teams on a year-long project with a community-based or other public interest organization addressing an issue of social justice concern. Provides a foundational understanding of the project's social and historical context as well as the fundamentals of teamwork.

**LAW 6161. Legal Skills in Social Context: Social Justice Project. (2 Hours)**

Examines how to use law to assist underrepresented populations and furthers students' development of legal skills. Drawing on their understanding of social and historical context and their legal research, writing, and project management skills, students create deliverables for a partner organization's use. Offers students an opportunity to further develop digital presentation and oral communication skills through a multi-media presentation.

**Prerequisite(s):** LAW 6160 with a minimum grade of CR or LAW 6160 with a minimum grade of CR

**LAW 6165. Legal Skills in Social Context: Foundations of Legal Research and Writing. (2 Hours)**

Introduces fundamental principles of legal analysis, objective legal writing, and legal research, with an emphasis on fostering a critical analytical mindset with which to interpret and apply legal doctrines, both orally and in writing. Builds foundational legal skills through continuous feedback on a series of assignments that require researching and drafting predictive legal documents.

**LAW 6166. Legal Skills in Social Context: Legal Research and Writing. (2 Hours)**

Offers students an opportunity to further hone their legal skills in other contexts, including persuasive advocacy and client counseling. Students research and draft documents to various audiences, including clients and courts, and participate in oral argument. Requires students to continue to develop previously acquired research, writing, and analytical skills in order to address more complex legal issues.

**Prerequisite(s):** LAW 6165 with a minimum grade of CR or LAW 6165 with a minimum grade of CR

**LAW 6301. Introduction to American Law and Legal Institutions. (2 Hours)**

This course is a general introduction to the American legal system for graduates of law programs outside the United States. The focus will be on the distinctive features of the American system, including how the U.S. common-law system differs from the civil-law system in place in most other countries. The three branches of government, federalism, the federal-state relationship, the constitutional protection of individual rights, civil and criminal procedure, and statutory and regulatory law will all be discussed.

**LAW 6302. Introduction to Legal Research and Writing for LLM Students. (2 Hours)**

This course introduces graduates of law programs outside the United States to the principles of U.S. legal discourse and to the basics of manual and electronic U.S. legal research. Students will have an opportunity to practice researching complex questions of U.S. law and writing memoranda based on their research.

**LAW 6313. Introduction to the Law of Contracts. (3 Hours)**

This course is designed to provide international LLM students with an introduction to U.S. contract law, with a special focus upon contracts for the sale of goods. Topics may include formation of contracts, contract interpretation, performance, and breach, remedies, and Articles 1 and 2 of the Uniform Commercial Code. This course is especially recommended for LLM students who wish to take a U.S. bar exam. This course is not open to JD students.

**LAW 6314. Introduction to U.S. Constitutional Law. (3 Hours)**

Provides international LLM students with an introduction to U.S. constitutional law. The course is especially recommended for LLM students who wish to take a U.S. bar exam. Topics may include judicial review, separation of powers, federalism, equal protection, state action, due process and fundamental rights, and the First Amendment.

**LAW 6315. Legal Research and Writing for LLM Students: Preparing for Co-op. (2 Hours)**

Introduces graduates of law programs outside the United States to the practical application of U.S. legal discourse and legal research in the workplace. Offers students an opportunity to apply what they have learned about U.S. legal writing and research to the types of tasks that they will be called upon to complete during their co-op internship work experience.

**Prerequisite(s):** LAW 6302 with a minimum grade of MP

**LAW 6316. Introduction to Civil Procedure. (3 Hours)**

This course is designed to provide international LLM students with an overall introduction to U.S. civil procedure. Topics will include personal and subject-matter jurisdiction, pleadings, discovery, choice of law (the Erie Doctrine), finality and preclusion, and class actions. The course is designed to emphasize the practical application of civil procedure law, and is especially recommended for LLM students who wish to take a U.S. bar exam. Not open to JD students.

**LAW 6400. Introduction to U.S. Law and Legal System. (3 Hours)**

Introduces principles and structures of the legal system in the United States. Covers the U.S. system of government, the U.S. judicial systems at the federal and state levels, U.S. sources of law, common law methodology, and the roles of legal professionals. Designed to familiarize the student with the relevant and governing legal principles that are used in American jurisprudence, including substantive and procedural law. Emphasizes legal terminology in our contemporary legal system.

**LAW 6401. Contracts. (3 Hours)**

Surveys the application of contract law in various contexts with case law, relevant portions of the Uniform Commercial Code, the Restatements, and treatises. Introduces students to practical issues in contract law theories and doctrines. Explores the bases of contract law, creation and termination rights, problems in contract formation, contract interpretation theories, and damages.

**LAW 6402. Torts. (3 Hours)**

Offers students an opportunity to obtain a thorough working knowledge of the key concepts of tort law in the United States. Covers issues related to intentional torts and negligence and the defenses that relate to tort claims.

**LAW 6403. Constitutional Law. (3 Hours)**

Offers a broad overview of constitutional law. Emphasizes the subjects of federalism, judicial review, due process, and individual rights.

**LAW 6404. Civil Procedure. (3 Hours)**

Examines the procedural aspects of civil disputes in the United States under both state and federal systems, as well as the court systems and processes of bringing and defending cases. Studies the unique U.S. process of the discovery of evidence, including depositions and document production.

**LAW 6405. Professional Responsibility. (3 Hours)**

Examines the rules that regulate the legal profession including the ABA Model Rules of Professional Conduct; the ABA Model Code of Judicial Conduct; the California Rules of Professional Conduct; relevant sections of the California Business and Professions Code; and leading case law, both federal and state, on the subject. Offers students an opportunity to gain a thorough understanding of the topics covered on the Multistate Professional Responsibility Examination, including lawyer advertising; solicitation of clients; specialization; conflicts of interest; competence; legal malpractice; fees; confidentiality; and obligations to clients, the court, and society. Students apply applicable ethics rules to identify and resolve ethical problems within the practice of law.

**LAW 6406. Criminal Law. (3 Hours)**

Covers both federal and state criminal law in the United States. Reviews the entire time frame of a crime, from commission through prosecution and possible imprisonment. Examines multiple types of crime, including white-collar crime, as well as procedural rules of criminal cases. Covers provisions of the Bill of Rights that regulate the government's pursuit, prosecution, and punishment of criminal defendants, with emphasis on the Fourth, Fifth, Sixth, and Eighth Amendments to the U.S. Constitution.

**LAW 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LAW 7000. Copyright. (3 Hours)**

Surveys the domestic and international laws and policies of copyright law, with a secondary emphasis on related areas of law such as rights of publicity, unfair competition, and contractual protection of ideas in varying degrees. Topics covered include the subject matter of copyright; ownership and transfer of copyrights; the rights afforded to copyright owners in the United States and via international treaties and conventions; duration of protection; infringement; and the Digital Millennium Copyright Act and remedies. Includes guest speakers who are involved in cutting-edge issues in copyright, which will allow students to hear directly from and start networking with practitioners and others involved in copyright law.

**LAW 7003. International Sales and Commercial Arbitration. (3 Hours)**

Examines the laws and commercial rules governing international sales of goods and the law and practice of international commercial arbitration. Course topics include the United Nations Convention on Contracts for the International Sale of Goods (CISG) and the rules of private international law that address gaps in the CISG.

**LAW 7004. Trademark. (3 Hours)**

Examines the precepts of trademark and unfair competition law. Investigates issues of ownership, registration, misappropriation, infringement, and dilution in the context of words, phrases, symbols, slogans, product design, and trade dress. Explores related issues such as false and comparative advertising, rights of publicity, and parody and free speech.

**LAW 7005. Mergers and Acquisitions. (3 Hours)**

Explores legal issues related to corporate mergers and acquisitions. Topics covered include acquisition structures and mechanics, shareholder voting and appraisal rights, board fiduciary duties, federal securities law requirements, anti-takeover defenses, accounting and tax issues, and antitrust considerations.

**LAW 7006. Secured Transactions. (3 Hours)**

Examines the rules governing transactions in which personal property and fixtures are used as collateral to secure an obligation. The primary source of authority is Article 9 of the Uniform Commercial Code but also introduces other applicable laws, including primarily the U.S. Bankruptcy Code. This body of law addresses not only the rights of the debtor and creditor inter se but also the rights of third parties with an interest in the collateral.

**LAW 7007. Securities Regulation. (3 Hours)**

Examines how the stock market and other securities markets are regulated in the United States. The primary focus is the Securities Act of 1933 and, to a lesser extent, the Securities Exchange Act of 1934. Covers how companies raise capital through IPOs and other offerings, including private placements, and the complicated regulatory framework that applies. In addition to discussing disclosure requirements for companies that decide to offer to sell their stock or debt to investors, the course takes an in-depth look at insider trading rules. Also touches on how corporate director elections are regulated as well as the rules that apply to tender offers.

**LAW 7009. Intellectual Property and Technology Law. (3 Hours)**

Explores the interplay between intellectual property law and evolving technology. In particular, focuses on the challenges faced by courts when applying intellectual property laws to technology not in existence at the time the laws were passed and on the policy issues raised by such challenges.

**LAW 7010. Insurance Law. (3 Hours)**

Introduces students to the principles governing the creation, sale, and enforcement of the most common forms of insurance in the United States. Explores personal liability, professional liability, commercial general liability, homeowner's, automobile, life and casualty, and health insurance. Discusses the peculiarities of each line as well as the problems common to all lines: moral hazard, adverse selection, and outright fraud. Covers the social function of insurance, as well as historical anomalies, in order to give students the broadest possible exposure to the issues lawyers confront regularly in this area of practice.

**LAW 7011. Personal Income Tax. (3 Hours)**

Introduces students to the basic concepts contained in the Internal Revenue Code. Emphasizes taxation of individuals but includes significant content applying concepts to business entities as well. Offers students an opportunity to learn to analyze statutes and regulations.

**LAW 7012. Introduction to Business Organizations. (2 Hours)**

Examines the structure and operation of business organizations in the United States. Examines agency law (which applies to all business entities) and then focuses on general partnerships. Offers students an opportunity to obtain basic foundational knowledge of business organizations for later study of advanced topics.

**LAW 7013. International Securities Regulation. (2 Hours)**

Examines international securities regulation related to business organizations. Topics include the regulation of individuals and businesses that operate outside the United States and cooperative relationships between the Securities and Exchange Commission and regulators from other countries.

**Prerequisite(s):** LAW 7012 (may be taken concurrently) with a minimum grade of C- or LAW 7323 with a minimum grade of P

**LAW 7014. Modern Privacy Challenges. (3 Hours)**

Examines existing and proposed laws relating to evolving concepts of privacy and confidentiality in various sectors of society, including business, healthcare, and the home. Topics include the historical framework for privacy regulation, types of privacy, issues arising in the home and workplace, issues related to personal autonomy, state laws affecting privacy and confidentiality, contractual provisions related to privacy, and the impacts of new technology.

**LAW 7015. Law, Technology, and Economic Development. (3 Hours)**

Explains the basics of transaction costs and market failures which arise in banking and financial systems, particularly in developing countries. Explains how technological innovations can potentially ameliorate these problems but then create their own. Assists students in developing laws and policies to address these problems and better use technology to support the economic and social development of emerging economies.

**LAW 7300. Administrative Law. (3 Hours)**

This course provides an introduction to the legal doctrines designed to empower and constrain government agencies and officials in their daily practice of governance. Topics include the constitutional status of administrative agencies, due process, the Administrative Procedure Act and the availability and standards of judicial review of agency actions. The course emphasizes the historical evolution of the modern administrative state and the regulatory agency's peculiar role in our system of governance.

**LAW 7301. Advanced Criminal Procedure: Adjudication. (3 Hours)**

This course closely examines some of the constitutional complexities in the prosecution and defense of criminal cases in state and federal courts. Students investigate how the law fashions the adjudicatory process and how the law evaluates what is "fair" and what is "legitimate" in formally deciding on whom to impose punishment. The course covers, among other things, pretrial detention, right to counsel, plea bargaining, discovery, trial processes, and sentencing.

**LAW 7303. Antitrust. (3 Hours)**

Examines federal antitrust laws, which were created to break apart the powerful business "trusts" of the late 1800s and have since been applied to markets as diverse as utilities, ski areas, sports leagues, copy machine repair services, and computer hardware and software. Explores the core principles of antitrust law, emphasizing three substantive areas: monopolization, horizontal merger analysis, and agreements among competitors. Offers students an opportunity to develop an understanding of antitrust law doctrine in the current economic context and its overlaps with other branches of economic law.

**LAW 7313. Secured Transactions. (3 Hours)**

A survey of commercial lending transactions, with particular emphasis on Article 9 of the Uniform Commercial Code, consumer legislation, relationship to real estate mortgage transactions, relationship to bankruptcy problems, fraudulent conveyances, federal tax liens, etc.

**LAW 7320. Constitutional Litigation. (3 Hours)**

In the first phase of the course, the class considers strategic and tactical decision-making in constitutional litigation. In the second phase, students report on the process of litigating cases involving constitutional issues. Relying on briefs, court records and interviews with counsel, students report to the class and prepare a research paper setting out their findings. The paper is a major commitment of time and energy; only students with a significant interest in litigation of constitutional questions should apply. Papers are eligible to satisfy the writing requirement.

**LAW 7323. Corporations. (4 Hours)**

This course relates to the formation, financial structure, and governance of business enterprises, especially incorporated businesses. Partnerships, limited partnerships, limited liability companies and limited liability partnerships are also explored, principally as they compare to the corporate form. The topics studied include: rights of creditors to hold principals of the enterprise liable; distribution of control within the corporation; fiduciary duties of directors and officers; key aspects of the federal securities laws (including the regulation of insider trading and proxies); organic changes (such as mergers); shifts in control (such as takeovers and freeze-outs); and legal implications of the roles of corporations in society. The course introduces some of the specialized concepts explored in detail in courses on Securities Regulation and Corporate Finance.

**LAW 7324. Securities Regulation. (3 Hours)**

Federal regulation of securities transactions originated in the New Deal investor protection legislation of the early 1930s and must now adapt to the changes and challenges of the 21st century. This course surveys major issues in the registration of initial public offerings ("IPOs") under the Securities Act of 1933 and relevant provisions of the Securities Exchange Act of 1934, civil liability provisions, and the major exemptions from registration. Students will engage in detailed statutory analysis, as well as analysis of judicial and administrative decisions. The material covered in the course also raises important public policy issues such as "market democracy" and the role of regulation, disclosure policy with regard to corporate accountability and social responsibility, and the implications of internet disclosure.

**LAW 7329. Environmental Law. (3 Hours)**

This course focuses on federal and state environmental laws. Topics include pollution control, waste management, and cleanup of contaminated land and water. The course explores legislative policy and regulatory decisions as well as enforcement issues. We will give attention to questions of environmental justice and to the strategic use of legal tools in working to ensure safe and healthy surroundings for diverse groups of people.

**LAW 7331. Estate Planning. (3 Hours)**

This basic upper-level course weaves together three strands that make up the discipline of estate planning. Strand 1 is an introduction to key elements of relevant law: property; creditor/debtor; wills, estates, and trusts; estate and gift tax; trust income taxation; and a touch of public benefits. Strand 2 introduces the tools and key components of an estate plan, such as Wills, Trusts, asset titling, and death beneficiary designations. Strand 3 weaves these together with and applies them to real-world frequently encountered situations using classroom hypotheticals to teach sound practice management, ethical considerations, blended family issues, and a mindset that plans for the knowable unknowns (e.g., not all potential beneficiaries may in the future be healthy, financially secure, still living, or even born yet).

**LAW 7332. Evidence. (4 Hours)**

This course examines how courtroom lawyers use the evidence rules to present their cases—notably, rules regarding relevance, hearsay, impeachment, character, and experts. The approach to the study of evidence will be primarily through the "problem" method—that is, applying the provisions of the Federal Rules of Evidence to concrete courtroom situations. Theoretical issues will be explored as a way to deepen the student's appreciation of how the evidence rules can and ought to be used in litigation.

**LAW 7333. Family Law. (3 Hours)**

This is a basic course in family law and family policy. The first half of the course explores state regulation of intimate relationships, asking what purposes marriage serves, and looking at the law of incest, polygamy and same sex marriage. The second half of the course examines practical problems in family law: cohabitants' rights; common law marriage; and the many issues relating to divorce, with a particular focus on money and children.

**LAW 7335. Health Law. (3,4 Hours)**

Examines the legal regulation of the provision of healthcare services. Focuses on the relationship between law and healthcare policy. Topics include access to health insurance and healthcare; healthcare financing; malpractice liability; the organization and responsibility of healthcare institutions, especially hospitals; the regulation of the quality of care; and the formulation of health policy. With permission of instructor, students may be able to take the course for an additional credit by completing a substantial paper or equivalent writing project (in addition to other course requirements) as required by the instructor.

**LAW 7336. Immigration Law. (3 Hours)**

This course is designed to give the student an overview of U.S. immigration law. The focus is on the day-to-day practice of immigration law, including an examination of the substantive and procedural aspects of this practice, and a historical analysis of the changes in our immigration laws and policies. Topics covered include non-immigrant and immigrant classifications, the preference system for immigrants, grounds of inadmissibility and deportability, relief from removal, asylum, citizenship, administrative and judicial review, and the immigration consequences of crimes.

**LAW 7338. International Law. (3 Hours)**

This course introduces students to fundamental concepts and unresolved problems in international law. We discuss historical and contemporary theoretical debates about the roles and utility of international law. Students are introduced to the sources of international law and to methods of international dispute resolution in domestic and international fora. This course explores the part that international law has played (or failed to play) in the prevention or conduct of war, the promotion of human rights and international economic development.

**LAW 7344. Accounting/Finance for Lawyers. (3 Hours)**

Accounting is described as the language of business. This course may be of interest to students seeking to understand accounting, finance, auditing, financial reporting, taxation, or exempt organization management commonly encountered by attorneys. The course introduces objectives and mechanics of financial reporting and accounting. In addition to traditional textual and case materials, we examine financial statements of a local public company including the balance sheet, income statement, statement of shareholders' equity, statement of cash flows, footnotes and management disclosure and analysis. We perform fundamental comparative financial analysis from an investor's viewpoint to determine each company's financial strengths and weaknesses. The course addresses the relationship between lawyer and auditor and reviews and analyzes recent financial reporting and financial scandals and audit failures.

**LAW 7350. Negotiation. (3 Hours)**

Negotiation is a course where students engage in simulated disputes and transactions, which are then debriefed in class. Through frequent in-class mini-negotiations and major simulations, the course focuses on: (1) negotiation planning, (2) case preparation and evaluation, (3) client counseling and informed client consent, (4) analysis of the bargaining range and principled concession patterns, (5) competitive, cooperative and problem-solving strategies, (6) information bargaining, (7) ethics and (8) critiques of negotiation patterns and institutions. Students are required to turn in preparation materials and to keep weekly journals, reviewed by the instructor, addressing their experiences in, and thoughts about, negotiations. Students are encouraged to internalize habits of analysis, prediction, preparation, and flexibility and to become more self-evaluative for their future negotiating experiences.

**LAW 7351. Prisoners' Rights Clinic. (8 Hours)**

Focuses on learning the law and procedures of parole and prisons in Massachusetts. Students handle a parole release hearing for a state prisoner serving a life sentence, with the possibility of parole, before all seven members of the parole board at a public hearing. In preparing one of these cases, students gain hands-on experience in criminal law and procedure, sentencing law, probation, prison classification and disciplinary systems, and often immigration law. Offers students an opportunity to develop and refine important advocacy skills including interviewing and counseling, case strategy development, thorough investigation techniques, witness preparation, and making strong opening and closing statements. The clinic is a mix of seminar class, individualized supervision meetings, and direct casework, which requires approximately a 25-hour weekly commitment.

**LAW 7358. Social Welfare Law. (3 Hours)**

This course examines American public assistance as a legal institution. After reviewing the historical, sociological and juridical roots of the welfare system, students examine the laws governing major assistance programs, especially eligibility requirements, rules governing grant determination, work and family rules, and procedural rights. Primary emphasis is on statutory and regulatory construction. The course explores methods by which lawyers can deal with the system: advocacy in the administrative process, litigation, legislative reform and representation of recipient organizations.

**LAW 7369. Intellectual Property. (3,4 Hours)**

Introduces the classic principles of copyright, patent, trademark, and trade secret law and explores the ways in which those principles are shifting and adapting in response to new technology. In our modern day "information economy," the law of intellectual property has taken on enormous importance to both creators and users of intellectual creations. With permission of instructor, students may be able to take the course for an additional credit by completing a substantial paper or equivalent writing project (in addition to other course requirements) as required by the instructor.

**LAW 7377. Trusts and Estates. (4 Hours)**

This basic course covers all aspects of inheritance, including intestacy, wills, common modern will substitutes, trusts, and future interests, with attention to rights of spouses and children, charitable interests, fiduciary duty, and other issues. The focus is practical, and students are required to write numerous short exercises—including analysis, planning advice, and formal drafting—to address realistic problems.

**LAW 7394. Land Use. (3 Hours)**

A survey of legal doctrines, techniques and institutions relating to regulation of the use of real property. Topics covered include constitutional questions of takings by public agencies, the scope of the police power as it affects land use and the basic techniques of zoning and subdivision control. Students study, among other issues, recent cases on exclusion of low income housing, current techniques to encourage housing development (inclusionary or "linkage" regulations) and First Amendment questions arising from land use controls.

**LAW 7398. Federal Courts and the Federal System. (4 Hours)**

The subject of this course is the distribution of power between the states and the federal government, and between the federal courts and other branches of the federal government as manifested in jurisdictional rules of the federal courts. The topics covered include the nature of the federal judicial function, the review of state court decisions by the United States Supreme Court, and the jurisdiction of federal district courts, with special emphasis on actions claiming constitutional protection against state official actions.

**LAW 7410. Domestic Violence Clinic. (8 Hours)**

Offers students an opportunity to develop traditional lawyering skills—including interviewing and counseling clients and preparing and presenting cases in court—in the context of a busy community court that handles thousands of domestic abuse cases each year. The School of Law's Domestic Violence Institute offers an upper-level clinic focused on violence prevention and criminal intervention at Dorchester District Court. The clinic seeks to train students to participate in a broader community-based response to domestic violence and to work collaboratively in interdisciplinary teams with battered women survivors, advocacy groups, and police and law enforcement personnel.

**Prerequisite(s):** LAW 7332 (may be taken concurrently) with a minimum grade of MP

**LAW 7417. Entertainment Law. (3 Hours)**

Examines legal issues in entertainment law. Explores how law and industry norms shape practices and outcomes in motion pictures, television, music, publishing, interactive digital media, and other creative industries. Topics may include rights of privacy and publicity, copyright law, trademark law, misappropriation of ideas, life rights, defamation, advertising and endorsement, constitutional issues, representation, insurance, labor and employment, and contracts.

**LAW 7424. Labor Law 1. (4 Hours)**

A general introduction to the law of labor relations through an examination of the National Labor Relations Act and leading cases, in conjunction with historical, social and economic materials. Topics include organization, union recognition, unfair labor practices and collective bargaining.

**LAW 7428. State & Local Government. (3 Hours)**

This course offers an introduction to the workings of state and local governments, and to the roles of law and of lawyers in shaping and controlling their operation. Topics to be covered include: the sources and scope of state and of local lawmaking authority, intergovernmental relationships, modes of citizen participation in and control over the governing process, and state and municipal fiscal structure and operations. In exploring these topics, the course will focus both on the practical roles played by attorneys (employed inside or outside of government) in the governmental processes and on the place of decentralized governmental units within the vision of a democratic polity.

**LAW 7429. Labor Law 2. (3 Hours)**

An advanced labor law course focusing on the law of the collective bargaining agreement. The course compares collective bargaining rights to other workplace rights systems, such as individual statutory entitlement and public employee constitutional rights.

**LAW 7434. Secured Transactions. (4 Hours)**

This course has as its principal focus the way that most credit in America is extended. The transactions covered range from the purchase by consumers of automobiles or large household goods on credit to mega-loans by banks to large corporations. The primary law studied is Article 9 of the Uniform Commercial Code as well as certain sections of the federal Bankruptcy Code. The course also seeks to introduce students to commercial law generally and to further their facility with issues of statutory construction.

**LAW 7443. Professional Responsibility. (3 Hours)**

This course focuses on the legal, ethical and professional dilemmas encountered by lawyers. Emphasis is on justice as a product of the quality of life that society provides to people rather than merely the process that the legal system provides once a crime or breach of duty has occurred. The course also provides students with a working knowledge of the American Bar Association's Model Rules of Professional Conduct and the Code of Professional Responsibility as well as an understanding of the underlying issues and a perspective within which to evaluate them. In addition, the course examines the distribution of legal services to poor and non-poor clients.

**LAW 7448. Employment Discrimination. (3 Hours)**

Explores the development of employment discrimination law, focusing on Title VII of the 1964 Civil Rights Act and its historical context and evolution. Analyzes issues including antidiscrimination laws, employee rights, employer responsibilities, and employment at will. Surveys landmark court decisions, legislative reforms, and policy developments in this ever-changing area of law and its ongoing impact on workplace practices and societal norms.

**LAW 7449. Alternative Dispute Resolution. (3 Hours)**

This course is designed to introduce the theory and practice of various dispute resolution mechanisms that are alternatives to the traditional litigation model for resolving disputes. Insofar as negotiation is the foundation of most ADR processes, the course begins there. We will analyze negotiation theory and strategy before adding mediation and collaborative law to the mix. We will look at how to represent clients in negotiation, mediation and collaborative law, how to prepare for these processes and how to develop effective strategies. The final weeks of the course will focus on understanding the essential attributes of arbitration.

**LAW 7454. U.S. Legal Research. (2 Hours)**

The course is designed to prepare law students for research in practice, clerkships, and legal scholarship. Students will evaluate legal research sources and use them effectively, expand skills in primary and secondary U.S. legal sources, become aware of non-legal information resources that could be useful to legal practice, and get an overview of public international law and foreign legal research. Since learning legal research requires a hands-on approach, students are required to complete assignments and in-class exercises. This course will emphasize cost-effective research, including print and Internet sources. The topics covered in this survey course will vary from year to year and may include immigration law, tax law, business law, environmental law and cultural property law among others.

**LAW 7469. Disability Law. (3 Hours)**

This course explores how the law treats individuals with disabilities. We will analyze what is meant by the term "disability" and consider constitutional review of state actions discriminating against individuals with disabilities. Particular attention will be given to the rights and obligations created by the Rehabilitation Act, the Americans with Disabilities Act and the Individuals with Disabilities Education Act. The rights of individuals with disabilities to be educated, work, receive healthcare, and enjoy public accommodations will be considered in depth. This course is designed for students wishing to represent individuals with disabilities as well as students who may represent employers and public accommodations.

**LAW 7475. First Amendment. (3 Hours)**

This course examines several rights protected by the First Amendment to the Constitution. The focus is on the principles and processes developed by the judiciary to protect various forms of speech, expression and association. The course does NOT deal with the free exercise of religion or the establishment clause. The course also focuses on integrating doctrine with the core values of the First Amendment as well as emphasizing the need for students to develop their own preferred approach to protecting free expression. The course does not, except tangentially, deal with other parts of the Bill of Rights.

**LAW 7479. Basic Income Taxation. (4 Hours)**

This introductory tax course covers the fundamental concepts and operations in income taxation. Tax issues are raised in the context of typical lawyer-client situations: the employment contract (fringe benefits, employee business expenses), buying and selling a house and other property, personal injury expenses and recoveries, and running a small business. An important aspect in understanding the details covered will be comprehension of the economic policy objectives, and unintended results, of specific tax provisions such as capital gains taxation. The course is focused on the statute, cases and administrative law that define the income tax base. Tax rates are also examined and tax unit issues are covered for individual wage-earners, married couples, children living in the home, pensioners and small businesses organized as sole proprietorships.

**LAW 7488. Sexuality, Gender, and the Law. (3 Hours)**

This course uses case law and theory to address doctrinal problems and justice concerns associated with gender and sexuality. The syllabus is organized around notions such as privacy, identity and consent, all of which are conceptual pillars upon which arguments in the domain of sexuality and gender typically rely. Doctrinal topics include same-sex marriage, sodomy, sexual harassment, discrimination, among others, but the course is not a doctrinal survey; it is a critical inquiry into key concepts that cut across doctrinal areas. Students should expect to write a paper and share some of what they have learned with the class.

**LAW 7491. International Human Rights and the Global Economy. (3 Hours)**

This course surveys the international human rights legal system. It includes the promotion and protection of economic, social, and cultural rights (such as rights to health, food, water, and education) and civil and political rights (such as equality and non-discrimination, the right to human security, the prohibition on torture, and rights to religious and cultural expression). We begin by examining the history and theoretical origins of human rights law. We then engage the legal framework under international and regional human rights treaties and interpretations of them by international, regional and domestic courts and other actors. We examine international, regional and domestic mechanisms for monitoring compliance. Finally, we grapple with tensions among cultural and religious imperatives and traditional human rights.

**LAW 7494. Bioethics and the Law. (3 Hours)**

Explores the intersection of law, medicine, and ethics in diverse contexts that call for the evaluation of policies and practices implicating individual or public health. Topics may include but are not limited to end-of-life care, reproductive technologies, vaccines and the management of public health emergencies, professional and research ethics, confidentiality in health information, and equitable access to healthcare.

**LAW 7495. Advanced Criminal Procedure: Investigation. (3 Hours)**

During this course, students will examine the law of criminal investigation. The primary focus of the course will be to present and discuss leading Supreme Court decisions in the field of constitutional criminal procedure. Students will study decisions which apply the Fourth, Fifth and Sixth Amendments and the Due Process Clause to the criminal justice process and the procedures through which criminal laws are enforced.

**LAW 7501. Patent Law. (3 Hours)**

This course will provide an in-depth review of patent law and practice. The course will cover the administrative process for obtaining patents, including the requirements for patentability. The course will also cover enforcement of patent rights and the defense of patent infringement suits. The course will be presented in a simple, non-technical manner so that students of all disciplines can learn and understand the concepts.

**LAW 7503. Business Bankruptcy. (3 Hours)**

This course deals with business reorganization under Chapter 11 of the Bankruptcy Code. The objective of Chapter 11 bankruptcy is to allow the debtor to modify and restructure its debt so that it can continue to operate its business. The course will cover matters that typically arise in a Chapter 11 case, such as the automatic stay, modification of debt, rejecting contracts, post-bankruptcy financing, creditors' claims, management of the debtor, and the plan of reorganization. The course will also address topical issues such as employee rights, retiree benefits, and mass tort claims, including asbestos and environmental claims.

**LAW 7512. Problems in Public Health Law. (3 Hours)**

This course will explore the rationales for using law to protect and preserve the public's health, the legal tools that may be used to achieve that end, and the conflicts and problems that may result from legal interventions. Topics discussed will include the use of law to reduce the spread of HIV and other infectious diseases, control of tobacco and other hazardous products, bioterrorism, and the threats TO CIVIL LIBERTIES AND MINORITY GROUPS engendered by all such legal efforts. This course is highly recommended for all students enrolled in the J.D./M.P.H. dual degree program, but is open to other students as well.

**LAW 7514. Natural Resources Law. (3 Hours)**

This course addresses legal requirements and institutions dealing with animal and plant species, biological resources, habitats, and ecosystems. Major themes include biological diversity, endangered and threatened species, public and private rights in migratory resources, public trust doctrine, the allocation of power among federal, state, and local governments, and the roles of administrative agencies in ecosystem management. The course provides opportunities to explore specific topics of interest such as environmental ethics, wetlands protection, fisheries law, Native American hunting rights and fishing rights, and management of national parks, forests, and grazing lands.

**LAW 7516. Legal Writing Workshop. (3 Hours)**

Focuses on strengthening and expanding writing and analytical skills through assignments and exercises that involve objective, advisory, and/or persuasive writing. Reviews essential skills of effective legal writing while simultaneously exposing students to the myriad documents that lawyers draft in practice. Asks students to draft an array of legal documents, which may include office memoranda, client letters, demand letters, jury instructions, pleadings, and/or trial or appellate briefs. Writing completed for this course that satisfies the upper-level writing requirement may be used to fulfill that requirement.

**LAW 7525. Law and Economic Development. (3,4 Hours)**

Examines prevailing economic theories of and strategies for economic development and the legal and institutional frameworks devised to implement these strategies. Considers what kinds of legal and institutional arrangements best facilitate economic growth, how law structures and shapes markets, what "development" is and how it can best be measured, and whether legal instruments can be used effectively to address underdevelopment in a structural way. Focuses on development in the so-called developing world while also exploring some strategies for addressing development in a local community context. Addresses several development case studies posing particular problems in specific regions and contexts. With permission of instructor, students may register for an additional credit by completing a substantial paper (in addition to other course requirements) as required by the instructor.

**LAW 7526. Juvenile Courts: Delinquency, Abuse, Neglect. (3 Hours)**

Examines the evolution of the juvenile court system and issues related to juvenile justice and child welfare. Includes the study of procedural and substantive principles related to court subject matter, including delinquency, youthful offender, status offense, and abuse and neglect jurisdiction. In attempting to focus on connecting theory to practice, the class employs a contextual lens by considering the larger communities and systems that affect children, families, and public safety. This entails consideration of the consequences of decisions and policies in and out of courtrooms. Related topics include adolescent development; racial, ethnic, and gender equity; access to educational and mental health services; and public health.

**LAW 7527. Public Health Advocacy Clinic. (4 Hours)**

Offers students an opportunity to gain experience in public interest law, health law, and litigation and to use innovative litigation or regulatory approaches to improve public health by working on real-world, clinical public health advocacy projects. Projects include demand letters, complaints, class actions, amicus briefs, legislative drafting, preparation of testimony, or submission of comments on issues ranging from tobacco products, e-cigarettes, sports betting, gun violence, occupational safety, unhealthy foods or beverages, and rapid responses to urgent public health developments. Serves clients including the Public Health Advocacy Institute; the Center for Public Health Litigation; and the Center for Health, Policy, and Law.

**LAW 7530. Education Law. (3 Hours)**

Surveys current issues in U.S. education law. Topics may include high-stakes testing, school choice and the charter school movement, resegregation, special education, the school-to-prison pipeline, and school funding.

**LAW 7535. Legal Interviewing and Counseling. (2,3 Hours)**

Students in this course will study the principles of interviewing and counseling, learning how to interview clients to identify their legal problems and to gather information on which solutions to those problems can be based. Students will also practice interviewing witnesses and students will be taught how to counsel clients—a process by which, having determined what the client's legal problems are, the lawyer helps clients make decisions by identifying potential strategies and solutions and their likely positive and negative consequences. Students will practice specific interviewing and counseling techniques and have the opportunity to receive feedback from classmates and the instructor.

**LAW 7539. Employment Law—Job Security and Rights. (3 Hours)**

This course surveys legal and policy issues concerning job security, focusing primarily on law governing the termination of private sector employment. Students develop an understanding of the history and scope of the underlying employment-at-will doctrine and the primary ways in which the at-will doctrine has been modified through common law and statute.

**LAW 7540. Employment Law—Compensation, Benefits, and Retirement. (3 Hours)**

This course surveys legal, economic, and social policy issues concerning wages and working time, leave, unemployment insurance, and retirement income. The course provides detailed coverage of the Fair Labor Standards Act (FLSA), the Family Medical Leave Act (FMLA), and the Unemployment Insurance program, and also provides introductions to retirement and survivor income under the Social Security Act and to pension regulation under the Employee Retirement Income Security Act (ERISA). The problems of low-wage workers and women workers receive special emphasis, as well as tensions between the design of the older, statutory schemes and contemporary trends in business and work organization.

**LAW 7550. Refugee and Asylum Law. (3 Hours)**

This course will explore the law of asylum and refugees. The primary focus will be on U.S. law as it has evolved since passage of the Refugee Act of 1980. This will include legislation and case law—both administrative and federal court cases. It will also look at relevant international law and standards utilized in other countries by way of comparison with U.S. Law. We will also examine the process of asylum adjudications to analyze issues of due process, credibility, cross cultural communication and integrity of the various legal procedures. We will explore new and emerging theories of asylum eligibility and policy developments which impact asylum seekers in the United States.

**LAW 7552. Jurisprudence. (3 Hours)**

Examines the most fundamental questions in philosophy of law. Covers foundational theories and texts in jurisprudence. Discusses the nature of law, the content of law, the relationship of law and morality, and the relationship of law and obligation in a larger normative context. Introduces various schools of thought in Anglo-American legal scholarship and invites critical examination of the core conceptual commitments of each framework. Encourages students to ask why theory matters in practice, whether the answer to the question "what is law?" matters to a practicing lawyer, and how theory becomes action.

**LAW 7556. Corporate Finance. (3 Hours)**

Corporate Finance considers sources of funding and capital structure of corporations, as well as decisions managers make to increase the value of a firm. This class is aimed at equipping lawyers with an ability to understand decision-making of business clients. The course introduces tools and methods used to evaluate projects and to allocate limited financial resources, as well as considerations regarding capital structure. We will cover valuation concepts, including present and future value computations, discount rates, net present value, the Efficient Capital Markets Hypothesis, relationship between risk and return, capital asset pricing model, as well as issues of leverage and capital structure. We will also examine the characteristics of financial instruments used by firms to raise capital, including common stock, preferred stock and debt instruments.

**LAW 7559. International Trade. (3 Hours)**

This course provides a comprehensive introduction to the legal framework for U.S. and international regulation of international trade. The course will include a brief introduction to the economics of trade and trade restriction measures. It will then focus on the World Trade Organization agreements regulating international trade in goods, services and intellectual property; it will provide an overview of the North American Free Trade Agreement; and it will examine U.S. trade laws particularly relief from "unfairly" traded imports, boycotts and trade sanctions.

**LAW 7569. International and Foreign Legal Research. (2 Hours)**

This course is designed to teach students how to research international and foreign legal materials. The course uses a combination of lectures, hands-on research exercises, and homework assignments. Students will have opportunities: to increase the quality of research by attaining substantive knowledge on international legal topics and the legal system in which their issue arises; to attain practical skills to brainstorm search terms, formulate issues, and evaluate legal research resources by reiterative process; and to increase flexibility and confidence in researching international and foreign law topics. Topics include: U.S. and Non-U.S. treaties, international custom, jurisprudence, and documents of the United Nations, the European Union, and NGOs. The class also explores research in topical areas such as human rights, immigration and refugee laws, and foreign laws.

**LAW 7572. Transactional Drafting Seminar. (3 Hours)**

This seminar will help students improve their writing in the context of transactional legal documents. The seminar will help students: adopt tools to achieve clear and concise writing; understand the purpose of each element of a contract and adopt the language that most clearly accomplishes that purpose; draft the operative provisions of a contract to express the agreement of the parties; and create an *architecture* for a contract to make individual provisions work together in a cohesive document. The seminar will address concepts applicable to a wide range of transactional legal documents, with emphasis on drafting in the context of corporate transactions, including employment issues, shareholders' rights, and mergers and acquisitions.

**LAW 7588. Reproductive Rights, Justice, and Health. (3 Hours)**

Introduces topics in reproductive rights and justice and examines how laws and policy shape reproductive lives through an intersectional lens. Addresses legal doctrine, the science of reproduction, and public health research. Critically assesses issues arising from reproductive health law, with particular focus on a reproductive justice framework that centers social, racial, and economic justice. Topics covered may include sexual and reproductive health law as it pertains to forced sterilization, contraception, abortion, pregnancy discrimination, birth and maternal mortality, healthcare in prisons, fertility, social welfare programs, and gender-affirming care.

**LAW 7590. Copyright Law. (3 Hours)**

This course examines the law of copyright in the United States, with some reference to international aspects. We will discuss the scope of copyright protection, the formalities of securing copyright, the nature of the rights afforded by copyright law, the fair use doctrine, and copyright enforcement. The course will place copyright in historical perspective, and consider tensions created by emerging industries. The course is open to upper level students, without prerequisite.

**LAW 7597. Civil Rights and Restorative Justice Clinic. (6 Hours)**

The CRRJ (Civil Rights and Restorative Justice) Clinic engages students in legal research, litigation and legislative initiatives relating to anti-civil rights violence in the United States. CRRJ clinic students assist law enforcement agencies considering criminal investigation and pursue civil litigation against government entities. One of CRRJ's projects, Reconstructing Cases of Racial Violence, involves researching cases where criminal prosecution may not be an option. Students reconstruct legal proceedings and conduct factual investigations. The project focuses on practical legal research skills and helps students integrate the law of torts, civil procedure, federal courts, criminal law, and constitutional law. Faculty will provide individual supervision of each student.

**LAW 7599. Pretrial Civil Practice and Advocacy. (2 Hours)**

This course provides the foundation to manage the pretrial phase of a civil action. Each class will consist of a lecture concerning an aspect of pretrial practice, followed by student conducted pretrial advocacy. Using model civil cases, the students will engage in most types of pretrial practice, including an initial client interview and basic legal analysis to evaluate and assert potential legal claims and defenses, witness selection and preparation, deposition and written discovery practice, dispositive motions, pretrial memoranda and settlement positions.

**LAW 7603. International Business Transactions. (3 Hours)**

This course deals with transnational commercial law. It addresses the legal framework for international sales transactions, including the commercial terms of the sales agreement, shipping contracts, insurance, financing arrangements, and customs documentation. It also examines foreign direct investment transactions, international franchise and distribution agreements, and contracts for the transfer of technology. Bribery of foreign officials and liability under US and international rules are also included. Dispute resolution will be considered briefly with emphasis on choice of law and forum, arbitration, and enforcement of arbitral awards and foreign judgments.

**LAW 7606. Drug Law and Policy. (3 Hours)**

The field of Drug Law is vast, spanning the discovery, manufacture, distribution, and consumption of chemical agents designed to alter the human condition. This course focuses on three domains of the broader subject: the evolution and current state of the Federal Food, Drug, and Cosmetic Act; the architecture of the drug regulation system in the U.S., including the distinct space occupied by the Food and Drug Administration, the Department of Agriculture, and the Drug Enforcement Agency; and the role of regulation and tort litigation in harmonizing drug policy with science. Designed around legal and policy case studies, this course is intended for students expecting to become involved in clinical practice involving pharmaceuticals as well those generally interested in the interplay of law and public health.

**LAW 7607. Consumer Law. (3 Hours)**

This course examines consumer transactions in formation, substance, and remedies. While the course will focus most on consumer credit, we will also examine consumer leasing, advertising; fraud; warranties; and product standards and safety.

**LAW 7608. American Legal Thought: Traditional and Critical. (3 Hours)**

This course contrasts critical-theoretic approaches to law (e.g., legal realism, critical legal studies, identity-based jurisprudence, socio-legal studies, transformative jurisprudence) with mainstream legal thinking. In part the course is an intellectual history of American law, and in part it addresses contemporary jurisprudence and legal theory. Drawing on students' personal experience, the course also examines American legal education and the professional socialization of law students. A "big" question underlying the course is whether legal work is a medium in which one can pursue projects oriented toward political and social change. There is no prerequisite for this course, and no prior background in legal theory, history, or jurisprudence is needed. All students are expected to read the assigned texts very closely and participate in discussing them in class.

**LAW 7610. Community Business Law Clinic. (8 Hours)**

Offers a unique opportunity to develop lawyering skills through the real-world experience of helping low-income and underserved entrepreneurs achieve their transactional goals and supporting community-led growth. Students, prepared and supported by an intensive seminar and close faculty supervision, assume the role of lawyers for their clients and their clients' community businesses on the often-complex legal issues that startups, entrepreneurs and small businesses face.

**LAW 7612. Wrongful Convictions and Post-Conviction Remedies. (3 Hours)**

The emergence of DNA testing has not only assisted law enforcement in solving crimes, but it has also helped to expose a problem that many observers of the criminal justice system have long suspected: that a number of actually innocent prisoners have been convicted in the United States. Given that biological evidence suitable for post-conviction DNA testing is available in only a smattering of cases, the exonerations generated by DNA represent only the tip of the innocence iceberg, so to speak. This class will explore (1) the primary factors that contribute to the phenomenon of wrongful convictions, (2) the state and federal procedures through which post-conviction claims are litigated and (3) potential reforms to protect against the conviction of the innocent.

**LAW 7614. Law Practice Management: Access to Justice. (3 Hours)**

This course challenges conventional law practice management by exploring means of methods of filling the market gap in the provision of legal services to middle class clients. Students will investigate and document ways to use improved marketing techniques, staffing patterns, technological innovations and a variety of other tools to provide legal services to underserved portions of the market in a sustainable and economically viable fashion. Students will conduct independent research to develop a law firm business plan; exploring a practice area of particular interest to them. This course is not solely geared toward the entrepreneurial attorney, but rather will assist anyone in the development of skills to bridge-the-gap between their theoretical education and its practical application to the practice of law.

**LAW 7619. Healthcare Fraud and Abuse Law. (3 Hours)**

This course provides an overview of the law relating to healthcare fraud. It will provide an overview of the healthcare fraud and abuse laws, emphasizing the role of whistleblowers, qui tam actions, criminal investigative techniques, trial issues inherent in white collar criminal prosecutions, innovative resolutions of corporate fraud including compliance programs, and sentencing. Topics will include an overview of the healthcare payment system, the frauds visited on that system, and the interplay of criminal prosecutions with the FDA regulation. This course is highly recommended for students in the JD/MPH program, LLM students specializing in health policy and law, and students interested in criminal law, but is open to others as well. Health Law is recommended but not required.

**LAW 7620. Human Behavior, Legal Doctrine, and Policy Design. (3 Hours)**

This course will compare accounts of human behavior, including the Utilitarian/Law and Economics view of man as a rational calculator of his self-interest, with classical and contemporary alternatives to that description, including Behavioral Economics. We will evaluate the reasons for doubting or crediting these competing accounts, and will then consider their implications for determining appropriate legal doctrines and regulatory approaches. For example, we may consider whether the views of human behavior which shape consumer protection case law and the Supreme Court's commercial speech doctrine are justified, and whether – and in what circumstances – regulations are appropriate which seek to help people by prescribing, proscribing, or "nudging" their behavior. Students are expected to participate in class and write a research paper which may satisfy the writing requirement.

**LAW 7622. Whistleblower Law. (2 Hours)**

This course provides an introduction to the legal issues related to whistleblowing, a dynamic new area in employment, corporate compliance, and anti-fraud law. It focuses on tort-like remedies and monetary rewards available to whistleblowers under the Dodd-Frank, Sarbanes-Oxley, Foreign Corrupt Practices and False Claims Acts, along with protections under tax law, the First Amendment, and common law. There will be a final exam and a short paper (approximately 2 pages in length).

**LAW 7624. Advanced Legal and Interdisciplinary Research. (2 Hours)**

Studies how to research specialized legal topics, highlighting both legal and nonlegal sources that reflect modern practice. Uses a combination of lectures, interactive hands-on sessions, real-life examples, and an in-depth final research and writing project. Students may explore state, federal, and international primary laws and regulations, as well as relevant nonlegal sources and how they interact with the law. Researches both print and electronic sources. Emphasizes different specialized topics such as health law, environmental law, etc.

**LAW 7629. Inside Counsel. (2 Hours)**

The legal departments of corporations represent a significant practice opportunity for lawyers interested in corporate and regulatory law. These corporate departments operate on a different model than law firms and regulatory agencies and offer careers that combine legal disciplines with business management skills. This course will examine the roles of corporate counsel inside U.S.-based corporations and not-for-profits, specifically: the value proposition of corporate counsel, common responsibilities, unique ethical issues, the implications of the Sarbanes-Oxley and Dodd-Frank acts, corporate governance, risk management and litigation. Students will be graded on their responses to mid-term and final essay questions and the demonstration of their comprehension of the subject matter in the classroom. Prior study of Corporate Law is preferred but not required.

**LAW 7633. Intellectual Property Law Clinic. (8 Hours)**

Requires students to provide intellectual property-related legal services to students, ventures, and other participants in the university's entrepreneurship and innovation ecosystem under the supervision of clinical faculty and staff. The clinic includes opportunities to address issues related to intellectual property rights, risks, and transactions for individuals and ventures in the university community; to collaborate with faculty and others on intellectual property learning modules, policies, presentations, or workshops for this community; to develop practice skills; and to participate in the organization and operation of a legal services office.

**Prerequisite(s):** LAW 7369 with a minimum grade of MP or LAW 7638 with a minimum grade of MP

**LAW 7634. Energy Law and Policy. (3 Hours)**

Climate change and carbon emissions are the most important issues shaping energy law and policy in the United States today. This course will provide an introduction to U.S. energy law and policy in that context and will be organized around the regulated electricity sector which alone produces about 40% of all U.S. greenhouse gas emissions. We will explore the dynamics of natural monopoly markets, public utilities and their regulation, and the interplay of state and federal power in the energy space. We examine coal, natural gas, nuclear power, hydropower, renewables, storage, and efficiency for their impacts and potential as electrical energy sources in a carbon-constrained world. We conclude by investigating the legal potential to proactively foster and sustain a transition to a carbon-sustainable energy economy.

**LAW 7635. Laboratory Seminar in Applied and Critical Legal Design. (4 Hours)**

Offers students an opportunity to critically engage with design methods and principles in the development of new solutions and ideas for our legal systems, institutions, and problems. Examines methodologies derived from the fields of product, service, and critical design. Emphasizes hands-on student engagement with structured creative processes, field observations, prototyping, or other methods derived from a diversity of creative disciplines. Students apply these methodologies and skills in the formulation of a response to a timely design question. Students' exploration of critical design is intended to foster a vision of a future world where everyone is empowered to use the law.

**LAW 7638. Trademark Law. (3 Hours)**

This course is about the intellectual property right known as a "trademark," a word or symbol that distinguishes source of goods or services from each other. Trademark law is part of unfair competition law, which protects against a variety of "deceptive" or "inequitable" business practices. The regulation of trademarks is considered a way to maintain a fair and efficient marketplace for businesses and consumers. This course will cover common and statutory law of trademark as well as deepening your legal analysis of intellectual property rights. The course will offer insight into how trademarks live and develop in culture so you can draw both on the black letter law and its nuances as well as on your experience as a consumer in order to advise clients.

**LAW 7640. Information Security Law. (3 Hours)**

This seminar will conduct a bleeding edge discussion of the state of the legal art in information security law – what is known in DC policy circles as "cybersecurity." While this field of law started in the 2000's by focusing on data breach notification, today the stakes are much higher. Consumer products that rely on computer code can now kill us, and one appropriately targeted zero day exploit could potentially devastate our economy. We will discuss why data breaches continue to run rampant, what duties of data care and code safety are owed to consumers, and how various government agencies are tackling the consumer protection and national security issues implicated by vulnerable computer code. You will never look at your gadgets the same way again.

**LAW 7647. Trial Practice. (2 Hours)**

An introduction to the tactical and strategic problems commonly encountered in the trial of civil and criminal cases is the main objective of this course. Attention is given to the forensic aspects of trial practice, techniques of direct and cross-examination, and opening and closing summations. Prior course work in Evidence is a prerequisite.

**Prerequisite(s):** LAW 7332 with a minimum grade of MP

**LAW 7651. Human Rights in the United States. (3 Hours)**

This seminar explores the role of international human rights frameworks and strategies in social justice lawyering in the United States. On a range of issues, lawyers are bringing human rights home. They are using human rights mechanisms of the United Nations and Inter-American Human Rights system, drawing on international human rights and comparative foreign law in litigation before U.S. courts, and engaging in other human rights-based advocacy such as documentation, organizing, and human rights education. Advocates find that a human rights approach provides important strategic leverage and highlights the interdependence of economic, social, cultural, civil, and political rights. We will use skills exercises, assignments and real-world problems to develop practical skills to address policies on local, state and national levels, and to support social movements.

**LAW 7652. Strategies for Bar Success. (3 Hours)**

This course eases students into bar exam preparation by focusing on contextualized substantive review of the most heavily tested topics on the bar. It overlays skill instruction on reading comprehension, issue identification, rule mastery, critical thinking, legal analysis and recognition of distractor skills. Students gain a strong conceptual understanding and in-depth knowledge of highly tested doctrines across two MBE subjects and will be taught how to develop, use and apply a flexible but strong analytical framework to solve bar exam problems. Limited to third-year law students.

**LAW 7656. Legal Research and Writing 2. (3 Hours)**

Reviews the foundational skills necessary for effective legal writing, including legal and factual analysis, use of authorities, large- and small-scale organization, concision, citation, grammar and punctuation, and revision. Focuses on building skills through exercises and shorter assignments in order to increase student confidence and improve writing and analytical skills. Students may be asked to draft office memoranda, client letters, and a trial or appellate brief. Writing completed for this course that satisfies the upper-level writing requirement may be used to fulfill that requirement.

**LAW 7657. Immigrant Justice Clinic. (8 Hours)**

Offers students, under the supervision of clinical faculty and staff, an opportunity to provide legal services to noncitizen clients and to develop knowledge and skills in immigration law practice. Students interview, research, plan, investigate, write, counsel, negotiate, and advocate for their clients. Emphasizes client-centered lawyering, cross-cultural awareness, trauma-informed interviewing, and self-care.

**LAW 7660. Disrupt the Cradle-to-Prison Pipeline—Restorative Justice. (3 Hours)**

This course examines how we construct the cradle/school to prison pipeline while focusing on several pivotal points that channel largely poor Black and Brown students into it. With an eye toward practical application, students will learn about, critique, problem solve and create pipeline disrupting solutions looking to restorative justice as a time-honored justice paradigm alternative to our western constructions.

**LAW 7664. Law and Inequality. (3,4 Hours)**

Explores inequality from a range of disciplinary perspectives and the difference that can make in a variety of legal, social, and economic contexts. Elaborates methodologies for mapping ways diverse legal regimes and concepts contribute to the production, recognition, reinforcement, and maintenance of hierarchies of privilege and disadvantage between individuals, groups, localities, regions, and nations. Identifies key legal drivers in the production of inequities and explores how they shift bargaining power, redistribute resources, or otherwise ameliorate inequities or their adverse consequences. Students research a circumstance of inequality and develop a legal map to engage it. With permission of instructor, students may register for an additional credit by completing a substantial paper or equivalent writing project (in addition to other course requirements) as required by the instructor.

**LAW 7669. Law and Technology. (3 Hours)**

Examines law and technology as both processes and artifacts endemic to human groups, who have been toolmakers and lawmakers since human history has been recorded. Yet, in recent times, development of technological things has outpaced development in the law, bringing about what we might describe as new “design challenges” within the law. Considers several disputes around ownership and property, and safety and risk, and offers students a conceptual framework from the social study of science and technology by which to understand technology and the law. Focuses on the regulation of “digital labor” and algorithmically convened labor markets, such as Uber.

**LAW 7672. Data Privacy Compliance in the 21st Century. (3 Hours)**

Introduces the tools needed to navigate the complex world of data privacy regulation. By following the growth of a hypothetical startup company as it confronts new data privacy and security issues, offers students an opportunity to evaluate the principles grounding data privacy regulations around the world; examine emerging data privacy legal regimes of various countries; and consider privacy laws, why they matter, and what compliance concerns they raise. Encompasses privacy and security issues involved in regulatory compliance, data breach response, government and internal investigations, litigation, and mergers and acquisitions. Also considers special circumstances of cross-border litigation and transactions, the special problems raised by supply chains and corporate social responsibility, and emerging concerns arising from big data and increasingly sophisticated artificial intelligence.

**LAW 7673. Immigrant Justice Practicum. (6 Hours)**

Offers students an opportunity to investigate, research, analyze, draft, and learn the necessary skills to zealously advocate for clients at various stages of the immigration process. Examines the challenges facing immigrants and how to assist in the representation of noncitizens in a variety of humanitarian-based immigration matters. Examines new regulations, policies, and rules at the immigration court, the asylum office, and other courts and agencies. Explores the U.S. immigration system and historical context for it at a deeper level.

**LAW 7675. Information Privacy Law. (3 Hours)**

Information privacy law concerns the collection, use, and disclosure of personal information. This course will address the interrelated web of torts, statutes, crimes, contracts, property rules, administrative regulations, procedural rules, and constitutional provisions that implicate information privacy. Topics covered in this course include: the difficulty in conceptualizing privacy, justifications for protecting privacy, privacy and the press, conflicts between privacy and free speech, wiretapping and government surveillance, national and international data protection frameworks, privacy and social media, anonymity, and the rules for cross-border data flows.

**LAW 7678. Legal Research Workshop. (1 Hour)**

Designed to assist students in developing and executing research plans for writing projects. Requires students to identify an appropriate project early in the course; the project may be one that the student creates specifically for the course, or it could be one undertaken for a law review note, a seminar, or an independent study in which the student is concurrently enrolled. Includes readings, lectures, demonstrations, and in-class and homework exercises, as well as peer and instructor feedback focused on research strategies. Requires students to periodically present their research strategies and results for their writing projects.

**LAW 7679. Race and the Law. (3 Hours)**

This course examines the role of the law in perpetuating and alleviating racial inequality in the United States. We will interrogate historical and contemporary debates about the law and racial inequality. We will bear down on a question that is often asked by critical race scholars: why does inequality persist despite massive legal transformation especially following the civil rights movement? We will approach this question by examining how the law and legal institutions shape racial identity and how ideas about race shape legal institutions. The course will also consider tensions and debates within critical race theory and among race scholars. We will excavate the stakes of these debates and the consequences (intended and unintended) of various legal reform projects designed to address racial inequality.

**LAW 7682. Historical Injustice and Reparation. (3 Hours)**

Examines historical injustice and reparation with a focus on the Afro-diasporic experience. Explores the genealogy of reparation as a tool of law and politics and associated debates in law, political theory, ethics, and history. Considers themes such as the effect of the passage of time on claims; determination of who owes and who is owed; the responsibility of state and nonstate actors, collectives, and "implicated subjects"; the mechanics of reparations; and the role of state apologies, truth projects, and memory sites. Looks at the global movement to address slavery's legacy. Explores gendered practices, land redistribution claims, and design and implementation challenges. Uses case studies to deepen discussion and examine current movements for redress and reparation.

**LAW 7684. Anatomy of Autonomy. (3 Hours)**

Examines what it means to be a person in the eyes of the law and the rhetorical framing that infuses our conception of living subjects, legal persons, nonpersons, and things. The line between human and subhuman, or person and thing, is given new urgency when limits of incarceration, torture, human trafficking, medical experimentation, and right to due process turn on new meanings of words like enemy combatant, IQ, underclass, market choice, race, terror, or illegal immigration. Who we consider a person, who we label less than fully endowed, are questions that inform some of the most urgent legal and political questions of our time. Explores legal opinions; historical documents; and texts in philosophy, anthropology, linguistics, literary criticism, and popular culture.

**LAW 7687. First Amendment Seminar. The Religion Clauses. (3 Hours)**

Examines the religion clauses of the First Amendment and related statutory regimes, emphasizing the U.S. Supreme Court's free exercise and establishment clause jurisprudence. Evaluates individual and institutional claims of religious liberty. Explores the implications of government funding of religious institutions and activities. Discusses government expression or endorsement of religious messages.

**LAW 7688. Social Policy and the Tax Code. (3 Hours)**

Offers students an opportunity to obtain an understanding of how tax laws shape and are a major driver of social policy. Emphasizes the redistributive qualities and potentials of such policies and examines their design, implementation, and administration. Draws on legal methodologies as well as those from allied social sciences. May include such topics as healthcare, housing, and income support.

**LAW 7690. Introduction to Writing for Litigation. (1 Hour)**

Introduces students to litigation documents, including engagement and demand letters; complaints; answers; discovery requests (such as interrogatories, requests for the production of documents, and requests for admission); and motions. Considers audience, purpose, and components in drafting a document, taking into account relevant strategic considerations and general principles that apply to all litigation documents. Examines the protections associated with attorney-client privilege and attorney work product. Offers students an opportunity to review and draft a variety of litigation documents, to find and modify sample documents, and to find and apply the rules of the relevant jurisdiction.

**LAW 7691. Housing Rights Advocacy Clinic. (8 Hours)**

Offers students an opportunity to obtain hands-on experience in litigating housing-related matters, under the close supervision of clinical faculty. Students advise and represent clients facing housing insecurity, with opportunities to appear in court and before agency officials. Emphasizes ethical, client-centered representation; housing law and procedure; the practice of core litigation skills; and collaborative work with local community organizations advancing housing justice. Students attend weekly seminar and supervision meetings to develop their casework, as well as examine and think critically about the role of the lawyer, client, courts, and community in housing rights advocacy.

**Prerequisite(s):** LAW 7332 (may be taken concurrently) with a minimum grade of MP

**LAW 7692. Collaborative Businesses. (2-3 Hours)**

Examines the fundamental principles, structures, finance, management, and governance associated with collaborative businesses (with a focus on co-operatives).

**LAW 7693. Business Organizations. (4 Hours)**

Exposes students to a broad range of fundamental entity, business, and planning concepts encountered when representing corporations, limited liability companies, and partnership entities. Includes choice of entity, agency law, ethical challenges, and corporate transition planning. Beyond core doctrinal issues, the course focuses on the practical and analytical challenges of the business planning and client counseling process. Additional topics may include oppression avoidance, controlling shareholder risks, hostile takeover bids, executive compensation, risk management, and more.

**LAW 7695. Drug and Device Innovation: Law and Policy. (3 Hours)**

Introduces students to innovation law and policy in the context of drugs and devices regulated by the Food Drug Administration (FDA). Surveys the suite of incentives policymakers can use, purposefully or inadvertently, to shape drug and device development. Combines analysis from law, economics, and health policy.

**LAW 7696. Federal Indian Law. (2 Hours)**

Explores the complex legal relations between Native American tribes and federal and state governments, with a particular emphasis on Indigenous voices. Topics include federal, state, and tribal jurisdictional issues; tribal sovereignty; the federal trust responsibility; treaties and broken promises; land and resource management; the concept of "federal recognition" of tribes; and the status of reservations, among others.

**LAW 7697. Issues in Human Rights and Humanitarian Law. (3 Hours)**

Examines cutting-edge issues in human rights and humanitarian law through presentations by leading scholars in the field and in-depth seminar discussions. Emphasizes both core concepts and sophisticated critiques of human rights in a range of areas including conflict and war, accountability and justice, race and racism, and colonialism and inequality.

**LAW 7698. AI for Lawyers: Uses, Risks, and Regulation. (2 Hours)**

Introduces law students to the evolving world of artificial intelligence. Designed to prepare law students to enter legal workplaces being rapidly transformed by AI. Presents a broad overview of the technology underlying AI tools. Focuses specifically on generative AI, and examines how the Rules of Professional Conduct govern lawyers' engagement with AI. Examines the sources and risks of bias and hallucinations in current generative AI, as well as the intentional and unintentional misuse of the technology. Covers current and proposed legislative and regulatory schemes governing development and implementation of AI at the international, federal, and state levels. Offers student teams an opportunity to imagine and propose generative AI tools for self-represented litigants.

**LAW 7699. Efforts in Criminal Law Minimalism. (3 Hours)**

Examines several recent efforts in criminal legal reform. Introduces the recent abolition movement, emphasizing an understanding of critiques of policing and mass incarceration. Presents several efforts to change the criminal system including efforts to halt racialized policing; remove police from particular settings; reform pretrial detention; implement change within the trial process, such as Batson reform; and reform sentencing. These reform efforts include legislative reform, judicial challenges, community organization, and public media campaigns. Offers students an opportunity to develop their knowledge of advanced criminal procedure in the context of ongoing efforts to change a deeply flawed system.

**LAW 7700. Intellectual Property and Social Justice. (3 Hours)**

Examines the social justice aspects of different forms of intellectual property. Combines a study of contemporary issues in law and society with appropriate readings that provide theoretical, doctrinal, and social context for the use of and resistance to intellectual property.

**Prerequisite(s):** LAW 7369 (may be taken concurrently) with a minimum grade of MP or LAW 7501 (may be taken concurrently) with a minimum grade of MP or LAW 7590 (may be taken concurrently) with a minimum grade of MP or LAW 7638 (may be taken concurrently) with a minimum grade of MP or LAW 7633 (may be taken concurrently) with a minimum grade of MP

**LAW 7701. Strategies for Bar Success: Advanced Skills. (2 Hours)**

Continues students' bar exam preparation by focusing on contextualized substantive review of the most heavily tested topics on the bar exam. Overlays advanced skill instruction on reading comprehension, issue identification, rule mastery, critical thinking, legal analysis, and recognition of distractor skills. Offers students an opportunity to gain a conceptual understanding and in-depth knowledge of highly tested doctrines across multistate bar exam subjects and to develop, use, and apply a flexible but strong analytical framework to solve bar exam problems. Graded on a pass/fail basis.

**Prerequisite(s):** LAW 7652 with a minimum grade of MP

**LAW 7702. Crimmigration Law: The Intersection of Criminal Law and Immigration Law. (3 Hours)**

Introduces students to the intersection of immigration law and criminal law, including the immigration consequences of criminal activity, the criminal consequences of immigration law violations, and the doctrine governing immigration detention. Offers students an opportunity to obtain the skills necessary to advise noncitizen criminal defendants regarding the immigration consequences of plea agreements and to advise noncitizens with prior involvement in the criminal justice system regarding immigration law matters.

**LAW 7703. Spatial Justice, Legal Ethnography, and the Lawscape. (2 Hours)**

Surveys the intersections of law, space, and society through the lenses of spatial justice and legal ethnography. Focuses on critical analysis of the concepts of spatial justice, alongside contemporary perspectives on reparative spatial futures and intersectionality. Examines the lawscape; the role of the body; and the atmosphere in shaping how legal frameworks and spatial arrangements influence social justice issues, power dynamics, and access to resources. Offers students an opportunity to engage with creative methods in presenting their site-based ethnographic research, integrating experiential with legal analysis. Designed to prepare students to advocate for fair and inclusive policies in areas such as housing disparities, environmental justice, and urban planning.

**LAW 7704. Family Violence Immigration Practicum. (6 Hours)**

Covers representation to family violence survivors in their immigration matters. Cases might involve but are not limited to SIJS, U visa, T visa, and VAWA applications. Offers students an opportunity to engage in holistic, client-centered representation and to gain experience and training in a variety of legal skills, particularly emphasizing trauma-informed interviewing and counseling, litigation before courts and administrative bodies, cross-cultural competency, and self-care.

**Prerequisite(s):** LAW 7336 (may be taken concurrently) with a minimum grade of MP or LAW 7550 (may be taken concurrently) with a minimum grade of MP

**LAW 7705. Law and Global Technology. (3 Hours)**

Investigates the interaction between law and technology through an infrastructural lens. Offers technical introductions to digital infrastructures—including ad tech, the internet, and AI—and discusses the legal issues surrounding those infrastructures. Explores the difficulties in applying long-standing regulatory theories to emerging technology by studying recent legislation, litigation, and scholarship. No prior technical experience is required or expected.

**LAW 7706. State Constitutions and the Protection of Individual Rights. (3 Hours)**

Introduces the unique role that state constitutions play in our federal system. Surveys the historical development of state constitutions and the connections between state constitutions and national constitutional developments. Emphasizes the role of state constitutions in protecting individual rights.

**Prerequisite(s):** LAW 6101 (may be taken concurrently) with a minimum grade of MP or LAW 6314 (may be taken concurrently) with a minimum grade of MP

**LAW 7927. Applied Learning Experience for JD MPH. (3 Hours)**

Work completed for this individualized instruction course fulfills the capstone requirement for the Master of Public Health (MPH) portion of the Dual JD MPH Program with Tufts University. The requirement is known as the Applied Learning Experience and it earns 3 Northeastern University Law school credits. Students fulfilling this required course spend a minimum of 160 hours in a public health agency completing a project related to public health and law. It is both an academic and practice experience where students use their legal and public health knowledge and skills to undertake a discrete project in a public health agency. A final paper and presentation are required.

**LAW 7928. LSSC Lawyering Fellow Seminar. (1 Hour)**

Offers additional support and training for students serving as Lawyering Fellows for the social justice component of the Legal Skills in Social Context (LSSC) class for first-year law students. Explores social justice topics covered in LSSC in greater depth. Offers students an opportunity to obtain training in the skills necessary to facilitate discussions of those topics. Examines theories of effective collaboration and group development and introduces techniques for fostering successful team dynamics. Provides guidance on how to engage in effective critique and feedback and how to supervise students in their project work.

**Corequisite(s):** LAW 7931

**LAW 7929. Moot Courts and Legal Competitions. (1-4 Hours)**

This individualized instruction program allows students to participate in a variety of professional competitions: moot court, mock trial, mediation, client counseling and writing competitions. Under the supervision of a faculty member, participants in these competitions devote substantial time and effort to researching, writing, and preparing for oral arguments or advocacy. In recognition of the effort required to participate in these competitions, participants are awarded up to three (3) credits for the experience, provided they satisfactorily (i) complete the required written submission, (ii) participate in a number of rounds of practice argument, and (iii) attend and participate in the competition. May be repeated up to five times for up to 6 total credits.

**LAW 7931. LSSC Lawyering Fellow. (3 Hours)**

Assists LSSC faculty in all aspects of the first-year LSSC course. Working closely with a supervising faculty member, Lawyering Fellows provide critique and feedback on first-year students' written and oral work, create legal research plans, identify areas for field research, communicate with representatives from the partner organizations, and help to foster strong team dynamics and development. May be repeated once.

**LAW 7933. Scholarly Legal Writing. (2 Hours)**

Introduces basic concepts and principles of scholarly legal writing. Requires students to produce a piece of legal writing on a complex legal issue of their choice. The scholarly writing is expected to meet the standards of the upper-level rigorous writing requirement and be of publishable quality, analyzing an original legal issue.

**LAW 7934. Law Review - Senior Editor. (0.5,1 Hours)**

Offers those who have completed one term of staff work as associate editor or who have otherwise been promoted at the discretion of the editorial board the position of senior editor at the Northeastern University Law Review. Senior editors work under the supervision of faculty advisors and editorial board members in support of the mission of the Law Review: to publish legal scholarship in its flagship print journal and online platforms. Tasks may include citation checking, editing, supervision of associate editors, assistance with the writing competition and new member selection, and other duties in support of publishing content. Students may take up to 1 credit in each of their second-year and third-year terms with permission of the instructor. Graded on a credit/fail basis. May be repeated three times for a maximum of two semester hours.

**LAW 7935. Law Review - Editorial Board Member. (1,2 Hours)**

The Northeastern University Law Review publishes legal scholarship in its flagship print journal and on-line platforms. Operations are managed by an Editorial Board. In addition to the three Executive Editors who lead the E-Board, members include Articles Editors, Extra Legal Editor, Forum Editor, Publications Editor, and Symposium Editor. E-Board members work under supervision of the Faculty Advisors and Executive Editors. Editors develop articles and content, facilitate events and the publication process, and work with staff and senior staff. Individual position descriptions define additional specific responsibilities for each position. This course is graded on a credit/fail basis. May be repeated two times for a maximum of three semester hours.

**LAW 7936. Law Review - Executive Editor. (1-3 Hours)**

The Northeastern University Law Review publishes legal scholarship in its flagship print journal and on-line platforms. Operations are managed by an Editorial Board, led by three Executive Editors per rotation: Editor-in-Chief, Managing Editor, and Executive Articles Editor. Executive Editors work under supervision of the Faculty Advisors. In the broadest sense, they manage operations, production, and staff, make editorial choices, and ensure ethical operation that meets legal and financial obligations. Though their specific roles require different specific actions, as defined in their position descriptions, Executive Editors often share work and are ultimately responsible for doing what is necessary to ensure a successful Law Review. This course is graded on a credit/fail basis. May be repeated two times for a maximum of five semester hours.

**LAW 7937. Teaching Assistant. (1-3 Hours)**

Working under the direct supervision of a full-time faculty member, an upper level student in good academic standing may serve as a teaching assistant for first year or upper level courses. Teaching assistants may be required to attend classes and complete all reading assignments. Other responsibilities may include, but are not limited to, conducting review sessions, classroom exercises or other forms of direct instruction; holding office hours or meetings with individual students taking the course; and assisting in the development of course materials and assessments. In addition, teaching assistants are expected to meet regularly with the professor. May be repeated three times for a maximum of six hours.

**LAW 7938. Research Assistant. (1-3 Hours)**

An upper level student in good standing may serve as a faculty Research Assistant. The student will work with a full-time faculty member on a supervised project relating to the faculty member's teaching or scholarly activities. The project will provide the student with supervised research and/or writing experience as well as an opportunity to engage in analytical discourse with the faculty member. May be repeated three times for a maximum of six hours.

**LAW 7940. Reflections on Lawyering. (1 Hour)**

Offers students an opportunity to reflect on their legal work experiences. Examines the roles of lawyers and the nature of legal work, drawing on assigned readings, lectures, and students' own experiences. Discusses the professional obligations of lawyers and identifies skills and knowledge needed for effective lawyering. Considers both how students' own legal careers may develop over time and how the legal profession itself may evolve.

**Corequisite(s):** LAW 7941

**LAW 7941. Public Interest / Public Service Field Placement. (7 Hours)**

Offers students an opportunity to complete a field placement of at least 350 hours with a public interest organization, a government entity, or a judge. Fieldwork may assist students in expanding both their legal knowledge and their understanding of the legal profession, as well as an opportunity to develop their skills related to research and writing on legal and policy matters, preparation of written and oral presentations, client interviewing and advocacy, and/or litigation preparation.

**Corequisite(s):** LAW 7940

**LAW 7945. Field Placement Seminar. (2 Hours)**

Offers students an opportunity for structured reflection on their individual experiences in a field placement. Specific topics may include ethical obligations, the nature of legal work, the social context of the changing legal profession, the role of interdisciplinary insights in legal problem solving, and the use of varying modes of communication in the legal workplace. Students reflect on the ways in which their field placement draws from or builds upon previous coursework and legal experience.

**Corequisite(s):** LAW 7946

**LAW 7946. Field Placement. (6 Hours)**

Offers students an opportunity to complete a 300-hour field placement under the supervision of an attorney. Fieldwork may assist students in developing skills related to tasks such as researching and writing on legal and policy matters, preparation of written and oral presentations, client interviewing and advocacy, and litigation preparation.

**Prerequisite(s):** LAW 7954 with a minimum grade of CR or LAW 7955 with a minimum grade of CR or LAW 7956 with a minimum grade of CR or LAW 7957 with a minimum grade of CR

**Corequisite(s):** LAW 7945

**LAW 7949. Independent Field Placement. (2-4 Hours)**

Offers students fieldwork under the supervision of an attorney in the public or judicial sector. Students have an opportunity to obtain substantial lawyering experience that is reasonably similar to the experience of a lawyer advising or representing a client or engaging in other lawyering tasks. Includes regular reflection on their work with their faculty supervisor. Comprises 50 hours of fieldwork per credit; students may enroll in the field placement for 2, 3, or 4 credits. May be repeated twice for a maximum of 6 credits.

**LAW 7954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated once.

**LAW 7955. Co-op Work Experience Abroad - Half-Time. (0 Hours)**

Offers eligible students an opportunity for work experience abroad.

**LAW 7956. Public Interest and Government Co-op Work Experience - Half-Time. (0 Hours)**

Offers eligible students an opportunity for work experience in a public interest or government setting.

**LAW 7957. Public Interest and Government Co-op Work Experience Abroad - Half-Time. (0 Hours)**

Offers eligible students an opportunity for work experience in a public interest or government setting abroad.

**LAW 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LAW 7964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**LAW 7965. Co-op Work Experience Abroad. (0 Hours)**

Offers eligible students an opportunity for work experience abroad. May be repeated without limit.

**LAW 7966. Public Interest and Government Co-op Work Experience. (0 Hours)**

Offers eligible students an opportunity for work experience in a public interest or government setting. May be repeated without limit.

**LAW 7967. Public Interest and Government Co-op Work Experience Abroad. (0 Hours)**

Offers eligible students an opportunity for work experience in a public interest or government setting abroad. May be repeated without limit.

**LAW 7976. Directed Study. (1-6 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**LAW 7979. Legal Technology and Legal Operations. (1 Hour)**

Examines legal technology concepts and approaches that are currently used in legal practice and will become increasingly important in the future. Legal technology is rapidly transforming both the nature and practice of law. Explores this transformation and its implications. Topics include legal informatics; students consider where legal information resides and how it is manipulated and transmitted.

**LAW 7983. Special Topics in Law. (1-8 Hours)**

Covers special topics in law. May be repeated up to nine times for a maximum of 30 semester hours.

**Law and Policy - CPS (LWP)****LWP 6118. Historical Foundations of American Law. (3 Hours)**

Explores important law and policy issues that are capturing the attention of our national policymakers, think tanks, and journalists by taking a deep dive into Supreme Court cases and constitutional jurisprudence. Topics include, but are not limited to, privacy, gun control, civil rights and civil liberties, higher education, and other issues.

**LWP 6119. Current Law and Policy Debates: Our Nation's Capital and Beyond. (3 Hours)**

Explores important law and policy issues that are currently capturing the attention of our national policymakers, think tanks, and journalists. Topics may include, but are not limited to, civil rights and civil liberties; the right to privacy; policy issues such as healthcare, gun control, immigration, and education reform; and global issues including foreign policy, among others. Includes a residency in Washington, D.C.

**LWP 6120. Law and Legal Reasoning 1. (2-3 Hours)**

Introduces the U.S. lawmaking system, modes of legal reasoning, and legal research. Offers students an opportunity to obtain training in the skills and knowledge necessary to use legal resources and legal reasoning in academic and policy work. Explores basic legal and legislative concepts and terminology, the structures and functions of the federal legal and legislative systems, and different types of legal reasoning used in the three branches of the U.S. government. Examines how to read and understand key legal documents—including judicial opinions, statutes, and regulations—and how to use those materials in policy work.

**LWP 6121. Law and Legal Reasoning 2. (2-3 Hours)**

Introduces modes of legal reasoning used by lawmakers and policymakers, focusing on legislature and current administrative state. Examines the way Congress and administrative agencies develop and adopt statutes and regulations and how interpreting institutions analyze and apply these laws. At the course conclusion, students are expected to understand the organization of legislatures at multiple levels; how bills are developed and move through legislatures; the impact of various stakeholders and politics upon the legislative process; the different types of legal reasoning used in lawmaking; and to be able to read and understand statutes and regulations. Offers students an opportunity to add to their literature review by developing the ability to conduct legal research on their topic and understanding the role of relevant agencies to their topic.

**LWP 6122. Law and Legal Reasoning 3. (2-3 Hours)**

Introduces modes of legal reasoning, lawmaking, and policy influencing used by chief executives and their staffs and appointees in U.S. governments. Examines the constitutional role of the president and how the president employs delegated and implied powers to implement, make, and interpret law and otherwise influence policy. Explores how executive agencies promulgate regulations and how courts interpret and review regulatory processes and functions. Studies how to analyze and develop strategic insights into the organization of the executive branch; how legislation and other law is interpreted, implemented, and influenced by the executive; different executive strategies for influencing policy, including the federal budget process and informal methods of influencing policy; and how to read and comprehend regulations and regulatory materials.

**LWP 6123. Law and Legal Reasoning 4. (2-3 Hours)**

Offers a theoretical and practical overview of modes of legal reasoning, jurisprudence, and the application of such reasoning in contemporary legal cases. Topics include, but are not limited to, legal formalism and textualism, legal realism and pragmatism, critical legal studies, the living constitution, originalism, popular constitutionalism, and constitutional debates. Offers students an opportunity to apply these theories to historic and current cases and may offer opportunities for students to make comparisons across varied forms of government.

**LWP 6400. The Policy Making Process. (3 Hours)**

Introduces the structure of the political branches of government as well as foundational theories of the policy cycle and policy theorists, types of public policy, and the dimensions of conflict in creating and modifying public policy. Offers students an opportunity to apply policy theory practically through a proposed thesis research area or through case study examples.

**LWP 6401. Law and Policy Concepts 1. (3 Hours)**

Introduces students to the basic structure of the political branches of government, as well as foundational theories of the policy cycle and policy theorists, types of public policy, and the dimensions of conflict in the creation and modification of public policy. Topics may include, but are not limited to, problem definition, policy heuristics, and policy decisions including street-level bureaucracy. Students engage in practical application of policy theory through course assignments e.g., to their own proposed thesis research area or case examples.

**LWP 6402. Law and Policy Concepts 2: Strategizing for Public Policy. (2,3 Hours)**

Offers an overview of policymaking in the 21st century. Topics may include agenda setting, historical institutionalism, and interbranch perspectives of law and policy, as well as the interaction between state- and federal-level policy.

**LWP 6403. Law and Policy Concepts 3: Policy Case Studies. (2-3 Hours)**

Reviews how modern policy scholarship is applied to public policy challenges. Topics may include, but are not limited to, healthcare, criminal justice, environmental policy, labor policy, economic development, housing, or social welfare. Offers comparisons allowing students a broader perspective of issues that surround law and policy domestically in the United States and globally in other sovereign states.

**LWP 6404. Evaluation Research. (2-3 Hours)**

Introduces commonly used policy evaluation methods and tools. Offers students an opportunity to become familiar with the concepts, techniques, and practices of evaluation research; to learn how to read evaluation research critically; and to develop an appropriate evaluation plan for an ongoing program. Topics include outcome and impact evaluation, as well as cost-benefit analysis. May include opportunities to engage in the further development of the literature review for the doctoral thesis project, conducting a short policy analysis, and critical review of a policy evaluation.

**Prerequisite(s):** LWP 6424 with a minimum grade of B

**LWP 6410. Economics for Policy Analysis. (2-3 Hours)**

Offers an overview of the use of various economic theories in policy analysis and the tools of public finance. Topics may include the theory of public choice; market failure; economic concepts of public and private goods; externalities; and theories of social welfare, political economy, behavioral economics, sources of revenue and expenditure, tax structures, and other contemporary efforts to incentivize private investment to support social goals. Offers students an opportunity to understand these theories and concepts and apply them to a range of public policy and legal issues.

**LWP 6420. Quantitative Methods. (2,3 Hours)**

Introduces students to quantitative research methodology, including techniques needed to explore the student's doctoral thesis questions from a quantitative perspective. Offers students an opportunity to learn how to move from designing a quantitative study to data collection through analysis and interpretation of quantitative data. Topics include the basic logic of statistical inference, the manipulation and description of data, survey techniques, and secondary data analysis. Covers a variety of statistical techniques used within policy research to calculate descriptive statistics and techniques to evaluate the relationship between variables, such as crosstabs, t-tests, correlation, and regression analysis. Students apply these techniques through assignments and performing quantitative data analysis.

**Prerequisite(s):** LWP 6424 with a minimum grade of B

**LWP 6423. Qualitative Methods. (2,3 Hours)**

Introduces students to qualitative research, including techniques needed to explore the student's doctoral thesis questions from a qualitative perspective. Offers students an opportunity to learn how to move from design to data collection through analysis of qualitative data, as well as how one interprets and draws conclusions from qualitative data. Topics include qualitative data collection techniques, including in-depth group interviews, archival research, observation, and focus groups; coding qualitative data; and proper presentation of qualitative analyses and conclusions in formal academic writing such as the doctoral thesis. Students apply these techniques through assignments and performing qualitative data analysis.

**Prerequisite(s):** LWP 6424 with a minimum grade of B

**LWP 6424. Research Methods. (3 Hours)**

Introduces students to systematic methods of inquiry in law and policy doctoral study. Covers qualitative, quantitative, and mixed-methods approaches to research. Seeks to immediately assist students in thinking through their doctoral thesis research question and the development of the research methodologies suited to answer their research question. Topics may include research design; logic of inquiry; data collection; data management, data quality, communication and dissemination of results, evaluation of evidence; qualitative, quantitative, and mixed-methods approaches for law and policy research and analysis. Offers a general introduction to research ethics and Institutional Review Board processes and policies.

**LWP 6431. Political and Moral Ethics and Dilemmas. (2-3 Hours)**

Examines the political and moral responsibilities of public policymakers in government by asking what governments should do—considering principles that guide good, just, legitimate public policy—and what political actors should do—considering the many and often competing obligations that guide them in contesting what is good, just, and legitimate public policy. Assignments focus on applications of theoretical concepts from scholarly readings in philosophy and political theory to practical issues of public policy. Expects students to research distinct political and moral scholars, make presentations of their research, and complete a term paper addressing these ideas and scholars as applied to their doctoral project.

**LWP 6449. Public Policy Inquiry and Investigation. (3 Hours)**

Offers a practical and theoretical overview of how legislation and public policy are initially developed at the federal, state, and local levels, using a range of research and policy tools. After developing the technical aspects of a public policy proposal, those working for policy change face an array of strategic and tactical decisions about where and how to intervene in the complicated system of actors and institutions that establishes and implements public policies. Examines a wide range of policy topics to understand and evaluate how different policy strategies evolve in the interplay between branches and levels of government.

**LWP 6450. Public Policy Theory and Practice 1. (3 Hours)**

Offers a practical and theoretical overview of how legislation and public policy are initially developed at the federal, state, and local levels, using a range of research and policy tools. After developing the technical aspects of a public policy proposal, those working for policy change face an array of strategic and tactical decisions about where and how to intervene in the complicated system of actors and institutions that establishes and implements public policies. Examines a wide range of policy topics to understand and evaluate how different policy strategies evolve in the interplay between branches and levels of government.

**LWP 6451. Public Policy Design and Delivery. (3 Hours)**

Focuses on crafting effective strategies for advancing and passing concrete public policy changes at the federal, state, and local levels. Potential topics include, but are not limited to, health policy, education policy, jobs and economic policy, national security policy, immigration policy, and housing policy. Expects students to analyze policy change options and evaluate which strategies are most likely to produce desired changes. Offers students an opportunity to develop a theory-based and pragmatic framework for developing effective strategies to achieve desired policy change across a broad spectrum of issues and at all levels of government.

**LWP 6452. Public Policy Theory and Practice 3. (2-3 Hours)**

Focuses on the passage and implementation of public policy changes at the federal, state, and local levels. Guest experts lecture and initiate class discussions. Expects students to analyze policy change options and propose strategies to produce desired policy changes. Selected students are asked to lead and moderate class debates. Offers students an opportunity to develop a theory-based and pragmatic framework for developing effective strategies to achieve and implement desired policy change across a broad spectrum of issues and at all levels of government. Students may also be asked to examine ideas and proposals related to their doctoral theses.

**LWP 6500. Doctoral Research Design 1. (2,3 Hours)**

Builds upon prior courses in the methods sequence. Offers students an opportunity to further develop their knowledge and skills in research methodology and design. Students refine and add to the literature review and law and policy review conducted in prior course work and utilize their updated literature review to refine their design for their thesis research project for their selected topic area and to define the research methodology. By the end of the course, successful students are expected to have a doctoral thesis project proposal in their topic of interest, be ready to defend the proposal, and have prepared their IRB application for review in alignment with university requirements.

**Prerequisite(s):** LWP 6404 with a minimum grade of C- ; LWP 6420 with a minimum grade of C- ; LWP 6423 with a minimum grade of C-

**LWP 6501. Doctoral Research Design 2. (2-3 Hours)**

Offers students an opportunity to continue to develop the doctoral thesis project; to refine the doctoral thesis proposal and IRB application completed in Doctoral Research Design 1; to defend the doctoral thesis proposal with the thesis committee; and submit the IRB application. In addition, offers students an opportunity to deepen the narrative around data analysis, ethical considerations and theoretical frameworks, and begin to build the doctoral thesis. Explores in-depth relationships with data collection, management, and analysis in alignment with standards of rigor.

**Prerequisite(s):** LWP 6500 with a minimum grade of C-

**LWP 6502. Doctoral Research Design 3. (2-3 Hours)**

Offers students an opportunity to continue to develop the thesis project in the data collection, analysis, and reporting phase of the research. Continues in-depth exploration of data: collection, management, analysis, and handling of ethical concerns and standards of rigor. Offers students an opportunity to explore the conclusions that are possible from the results of their data collection and analysis. Introduces concepts of display of qualitative or quantitative data for the purpose of communicating data findings in the thesis and best practices in academic writing and presentation of data.

**LWP 6503. Doctoral Research Design 4. (2-6 Hours)**

Offers students an opportunity to continue to develop the thesis project, including finalizing data analysis and reporting of results and conclusions from research. Expects students to work toward a complete five-chapter dissertation (or accepted alternative) that will be edited and submitted for publication in the university dissertation repository. Students prepare for the culminating activity of the thesis defense and disseminating findings through scholarly channels.

**Prerequisite(s):** LWP 6502 with a minimum grade of C-

**LWP 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LWP 6995. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**LWP 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**LWP 7994. Thesis Continuation—Part Time. (0 Hours)**

Offers continued thesis supervision by members of the program. May be repeated up to three times.

**LWP 7996. Thesis Continuation. (0 Hours)**

Offers continuing thesis supervision by members of the department.

## Law and Public Policy (LPSC)

**LPSC 1101. Introduction to Law. (4 Hours)**

Examines the role of law and society from a regulatory, constitutional, and judicial perspective, noting the role each of these has played in shaping the current legal framework in the United States. Introduces students to the relationship between law, societal organizations (both nongovernmental organizations and not-for-profit organizations), the private sector, and the separate branches of government (the judiciary, congressional, and executive branches). Provides students with the opportunity to learn to legally analyze judicial opinions, prepare legal memoranda, and present an oral argument before a "judge."

**LPSC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LPSC 2301. Introduction to Law, Policy, and Society. (4 Hours)**

Examines the relationship of society to its laws: how society creates changes in law or policy via societal pressure and social movements (such as the environmental, women's rights, and corporate accountability movements); how law and policy affect individual rights and behavior; whether a society needs laws in order to function; the relationship between some branches of our government in effectuating social change; and some of the fundamental differences between societies governed by seemingly similar but pragmatically different laws, such as the right to a jury trial.

**LPSC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LPSC 3303. Topics in Law and Public Policy. (4 Hours)**

Covers special topics in law, policy, and society to fulfill students' interests. May be repeated without limit.

**Prerequisite(s):** LPSC 2201 with a minimum grade of B or LPSC 1101 with a minimum grade of B

**LPSC 3307. Understanding the Modern Supreme Court. (4 Hours)**

Offers a historical overview of the Supreme Court's role in American life, focusing on the 20th century. As a legal, political, and policymaking institution, the Supreme Court plays a central role in U.S. legal, political, and policy disputes. The justices possess a wide range of social, cultural, political, and economic views.

**Prerequisite(s):** LPSC 1101 with a minimum grade of B

**Attribute(s):** NUpath Societies/Institutions

**LPSC 3310. Law and Policy in the Nation's Capital. (1 Hour)**

Offers students an opportunity to travel to Washington, D.C., to meet with attorneys in the government, nonprofit, and private sectors; witness hearings; and see the various ways law and policy are made in our nation's capital. Upon return, students write a reflective paper connecting some of the readings provided in advance (democratic theory, overview of each branch of government, adversarial legalism, law of agencies) to speaker(s) and events from the visit. May be repeated twice, based on annual unique theme.

**Prerequisite(s):** LPSC 1101 with a minimum grade of B

**LPSC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LPSC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LPSC 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**LPSC 5201. Law and the City. (4 Hours)**

Examines key legal structures, court decisions, and social research to consider the ability of cities to make and implement public policies that directly affect the everyday lives of millions of people. American cities and their residents are frequently faced with similar legal and political questions. Topics include federalism, land-use planning and development, business regulation, gun control, school choice, public health, and climate adaptation initiatives.

**LPSC 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LPSC 7311. Strategizing Public Policy. (4 Hours)**

Provides a practical overview to crafting effective strategies for advancing public policy changes at the federal, state, and local level using a range of legislative, litigation, and other policy tools. Uses a series of case studies on a wide range of policy topics to understand and evaluate how different policy strategies evolve in the interplay between branches and levels of government. Takes an interbranch perspective on how policy is made and places particular emphasis on the role litigation and the courts play in policy making, an aspect of public policy formulation that is often downplayed or overlooked.

**LPSC 7312. Cities, Sustainability, and Climate Change. (4 Hours)**

Provides an overview of the various aspects of urban sustainability planning. Examines sustainability as an urban planning approach with both ecological and social justice goals. Covers sustainable planning and offers students an opportunity to understand it within the context of smart growth and the new urbanism. Focuses on the two areas in which cities can reduce energy consumption and greenhouse gas emissions—the built environment and transportation. From there, the course examines planning efforts to reduce demand on water and sewer systems and to create employment in renewable energy and other “clean-tech” occupations. The course ends by placing urban initiatives in the context of state and national policy.

**LPSC 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LPSC 7976. Directed Study. (1-4 Hours)**

Offers a supervised reading and research activity with faculty supervision approved by a committee of the Law, Policy, and Society faculty. May be repeated without limit.

**LPSC 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**LPSC 9990. Dissertation Term 1. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** LPSC 9000 with a minimum grade of S

**LPSC 9996. Dissertation Continuation. (0 Hours)**

Offers continued dissertation supervision by members of the department. May be repeated without limit.

**Prerequisite(s):** LPSC 9990 with a minimum grade of S or Dissertation Check with a score of REQ

**Leadership Studies - CPS (LDR)****LDR 1200. Assessing Your Leadership Capacity. (3 Hours)**

Introduces the methodologies and processes that are essential aspects of leadership: conceptualizing motivation, identifying traits, creating a vision, understanding influence, overcoming obstacles, developing character, and establishing a professional brand. Offers students an opportunity to focus on self-awareness, reflection, individual effectiveness, and self-assessment to learn how to recognize and utilize the differences between themselves and others. Students receive ongoing feedback from their peers and a chance to develop their own philosophy of leadership. The successful student should be able to answer the question, “What does it take to be a 21st-century leader?”

**LDR 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LDR 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LDR 3200. Leading and Managing Change. (3 Hours)**

Offers students an opportunity to develop the knowledge base necessary to lead and manage organizational change in all sectors with an emphasis on a 360-degree approach to understanding the many facets of change. Uses case studies that address various aspects of implementing change, such as: addressing the human psychology of change through innovative technology, social media, theoretical frameworks, understanding change agents, and operations. Encourages students to develop their views from both a management and nonmanagement perspective. The successful student should be able to gain knowledge and practical skills in how to connect change with strategy, anticipate resistance, assess readiness, and measure sustainability.

**Prerequisite(s):** LDR 1200 with a minimum grade of D- or CMN 2210 with a minimum grade of D- or HRM 2350 with a minimum grade of D- or LDR 1203 with a minimum grade of D- or LDR 1501 with a minimum grade of D- or MGT 2100 with a minimum grade of D- or MGT 2310 with a minimum grade of D-

**LDR 3250. Leading Teams Locally and Virtually. (3 Hours)**

Covers the skills needed to manage teams in one office, in multisite locations, internationally or virtually. Topics include effective communication strategies, how to structure teams within an intergenerational environment, and how to leverage individual strengths to lead high-performance teams. Offers students an opportunity to identify barriers, study strategic methods for overcoming obstacles, leverage technology to build virtual spaces for people and ideas, and work to develop a strategy to optimize team effectiveness through a shared process and peer coaching by participating on a cohort team. The successful student should be able to understand their role as a catalyst, visionary, and leader in the formation and success of any team.

**Prerequisite(s):** LDR 1200 with a minimum grade of D- or CMN 2210 with a minimum grade of D- or HRM 2350 with a minimum grade of D- or LDR 1203 with a minimum grade of D- or LDR 1501 with a minimum grade of D- or MGT 2100 with a minimum grade of D- or MGT 2310 with a minimum grade of D-

**LDR 3400. Evidence-Based Leadership and Decision Making. (3 Hours)**

Examines the components of evidence-based leadership that have been tested in various settings, shown to be effective, operational, and able to be used in solving real-world dilemmas. Emphasizes using decision-making models to analyze behaviors, align organizational goals, determine consequences, and make recommendations for actions leaders can make to solve problems. Studies the relationship(s) between scientific data, academic theory, technological advances, and changes in society toward the goal of understanding ethical problems. The successful student should be able to demonstrate increased information literacy, identify strategies for decision making, and know where to seek evidence needed in order to make high-quality decisions on a wide range of issues.

**Prerequisite(s):** (LDR 1200 with a minimum grade of D- or CMN 2210 with a minimum grade of D- or HRM 2350 with a minimum grade of D- or LDR 1203 with a minimum grade of D- or LDR 1501 with a minimum grade of D-); (MTH 2300 with a minimum grade of D- or MTH 2310 with a minimum grade of D- or MTH 3300 with a minimum grade of D- or ALY 2010 with a minimum grade of D-)

**Attribute(s):** NUpath Writing Intensive

**LDR 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LDR 4850. Strategic Decision Making (Capstone). (3 Hours)**

Offers students an opportunity to examine and test leadership theory in practice. Students demonstrate their leadership knowledge gained during their undergraduate studies by completing an experiential action-oriented project. Under faculty guidance and approval, each student must present a body of work that addresses a critical leadership topic that will enhance their professional development as a 21st-century leader. Experiences can be undertaken within any industry sector or at the workplace with supervisor approval. Past projects have included research studies, case studies, new products, leadership development plans, publications, journals, magazines, media/films, training programs, etc. Requires students to deliver a presentation on their project and share a culmination of learned outcomes.

**Prerequisite(s):** LDR 3400 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Integration Experience, NUpath Writing Intensive

**LDR 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**LDR 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LDR 4995. Practicum. (1-4 Hours)**

Integrates theory and practice through a structured consulting experience working with organizations or conducting an applications-oriented research study. Introduces the problem-solving consulting model. From problem identification through recommendations, offers student teams an opportunity to work with decision makers to solve organizational leadership issues or conduct practical research studies.

**LDR 6100. Developing Your Leadership Capability. (3 Hours)**

Seeks to establish the premise that leadership is a developed capability by exposing students to theories and alternative perspectives, including contemporary collaborative models. This is the foundation of the master's degree program. Offers students an opportunity to demonstrate a holistic perspective of leadership by gaining an appreciation for the self and how it relates to the greater world around them. Students take a series of leadership and professional assessments/instruments designed to increase self-awareness and to develop practice of critical reflection. From careful consideration of these perspectives, successful students then build a personal model of leadership that can be put to immediate use in work, community, or personal settings.

**LDR 6101. Leadership Challenge Lab. (1 Hour)**

Offers students an opportunity to participate in an intensive, group leadership learning experience that is challenge-based and experiential. Provides the foundation for a series of reflective, feedback-based activities that inform the development of a personalized leadership development plan, supported by peer and faculty coaching during the lab and in subsequent courses.

**LDR 6110. Leading Teams Strategically in a Global Environment. (3 Hours)**

Examines principles of building highly effective teams by analyzing the variety of interrelated practices underlying group dynamics. Offers students an opportunity to learn how teams operate, the value of diversity in teams, leadership skills that best support teams, characteristics of successful teams, stages of group development, and the challenges associated with leading virtual teams. Combines learning through case studies, interactive discussions, reflective journaling, and an experiential team-based exercise.

**LDR 6115. Developing Strategic and Authentic Leadership Communication. (3 Hours)**

Introduces students to different communication approaches to help them develop their authentic leadership voice, because today's dynamic global work environment requires leaders to have a broad set of communication skills. Offers students an opportunity to use interpersonal, technology-mediated, and intercultural communication competencies and techniques; to develop a strategic approach for leadership communication; and to define an action plan for continuous growth.

**LDR 6120. Developing Organizational Success through Leadership Development. (3 Hours)**

Focuses on developing leadership capacity, or bench strength, throughout an organization. Understanding organizational dynamics and developing leadership capacity within the organization are two critical challenges facing leaders today. Studies best practices for onboarding, developing, coaching, and mentoring leaders, as well as the systems, practices, and procedures required to develop leaders throughout an organization. Students participate in a coaching exercise, where they give and receive coaching from their peers in the program and from faculty.

**Prerequisite(s):** LDR 6100 with a minimum grade of C-

**LDR 6135. Ethical Leadership. (3 Hours)**

Considers leadership dilemmas that can arise when the individual's values conflict with those of the organization, or when a situation requires decisions with conflicting value sets. Students use case studies, their own experiences, and current events to examine actions leaders have taken and consequences faced when confronted with ethical dilemmas. Requires work on a real-life ethical dilemma for understanding in-depth reasoning of the problem and developing an action plan for solving and preventing similar problems at the organizational and societal levels. From these exercises and discussions, students have an opportunity to develop a personal model for ethical leadership.

**LDR 6140. Leadership Strategy, Design, and Practice. (3 Hours)**

Offers students an opportunity to build an understanding of the core concepts of strategy making and to achieve a strategic mind-set. This involves analyzing industry dynamics, responding to competitive challenges, and assessing the impact of the future of innovation and of change. Addresses the concepts of organizational strategy as a dynamic process and strategic decision making as students implement a plan for strategy development for a real organization.

**Prerequisite(s):** LDR 6100 with a minimum grade of C- ; LDR 6120 with a minimum grade of C-

**LDR 6145. Developing Sustainable Global Leadership. (3 Hours)**

Explores changing demographics as they impact present and future organizations. Examines their best-in-class motivations to more fully appreciate the backgrounds, cultures, experiences, viewpoints, styles, and contributions of a diverse workforce. Students reflect on leadership from key ethical, legal, policy, business, political, and societal frameworks. In a global economy, leaders of best-in-class organizations understand that creating an inclusive work environment is essential for continued competitive advantage.

**LDR 6150. Innovation and Organizational Transformation. (3 Hours)**

Studies the framework for organizational transformation as well as the competencies required to develop and implement a holistic model of change. Offers students an opportunity to learn how to think innovatively, design a vision for change, assess the current situation in relation to the desired change, and manage the transition from the current situation to the desired future. Within this course, students serve in the role of consultants or change agents for real-life organizations, assisting managers in their endeavors for organizational transformation. From this experience and class discussions, students have an opportunity to develop a personal model for change leadership and define an innovative action plan for personal growth as change agents.

**Prerequisite(s):** LDR 6100 with a minimum grade of C- ; LDR 6110 with a minimum grade of C-

**LDR 6190. Leadership Coaching for Purpose and Performance. (3 Hours)**

Focuses on developing coaching competencies needed to advance resonant, impactful, coaching relationships that result in the coachee developing leadership expertise aligned with their vision and the achievement of specific performance goals. Emphasizes foundational coaching competencies combined with a leadership coaching model that can be used in a variety of real-world coaching scenarios. Offers a variety of experiential coaching activities and concludes with a coaching practicum, where students have an opportunity to demonstrate their coaching expertise in a recorded coaching session.

**LDR 6195. Advanced Leadership Coaching: An Interdisciplinary Approach. (3 Hours)**

Examines the use and impact of evidence-based theoretical models—such as positive psychology, adult learning, experiential learning, and leadership—in the practice of leadership coaching. Considers the relationship between key coaching competencies identified in the International Coaching Federation Core Competency model and existing theoretical models. Examines the use of the different coaching frameworks to integrate theoretical models and leadership competencies while conducting coaching sessions. Offers students an opportunity to practice applying the various coaching models and frameworks during their coaching sessions, thereby demonstrating the impact of their leadership coaching expertise.

**Prerequisite(s):** LDR 6190 with a minimum grade of C-

**LDR 6323. Event Management. (3 Hours)**

Examines strategies and techniques required to run successful events. Offers students an opportunity to learn how to manage logistics; the who, what, where, when, and how of running the event; how to develop checklists and manage processes to keep things running smoothly; and how to have contingency plans. Covers the basic details involved in running events—size, budget, venue, hospitality, marketing, publicity management—and working with vendors, community organizations, spectators, and celebrities.

**LDR 6400. Sports Management. (3 Hours)**

Provides an overview of management and administration pertaining to all levels of athletics. Focuses on basic theories of management and administration in athletic organizations. Addresses planning, scheduling, and financing aspects required to run a successful athletics program. Offers students an opportunity to learn to develop communication and management skills with an emphasis placed on decision making.

**LDR 6405. Sport in Society. (3 Hours)**

Examines the role sports plays in society. Emphasizes improving society through sports by creating and developing community service, drug awareness, and violence prevention programs. Discusses sports within sociological, economic, and political backgrounds. Topics include ethics, organizational code of conduct, and ethical behavior within competitive athletic settings.

**LDR 6410. Leadership and Organization in Sport. (3 Hours)**

Introduces a set of personal, interpersonal, and team-based skills and competencies required for leadership roles in sport organizations. These skills include self-awareness, managing stress, creative problem solving, communicating effectively, gaining power and influencing others, correcting performance and motivation problems, managing conflict, and delegation. Also explores the application of these skills in various contexts within the sports industry.

**LDR 6427. Gender and Diversity in Sport. (3 Hours)**

Examines gender and diversity in sport. Emphasizes creating equal opportunity for participants and administrative and leadership personnel. Explores affirmative action, human resources, and recruiting tactics and strategies.

**LDR 6430. Sports Law. (3 Hours)**

Addresses the legal aspects of sports, recreation, and leisure services, with a focus on tort and contractual liability. Covers legal concepts of negligence and principles of risk management, legal issues related to equipment use, facility management, and accommodation for special populations. Offers sports managers an opportunity to obtain the fundamental legal knowledge necessary to operate in the increasingly complex sports environment.

**LDR 6435. Fiscal Practices in Sports. (3 Hours)**

Examines the financial and regulatory issues confronting sports, fitness, and recreation industry managers. Covers accounting principles, financial statements, and related concepts that help determine the viability and strength of financial decision making.

**LDR 6440. Sports Marketing and Promotions. (3 Hours)**

Presents an overview of the various techniques and strategies used to meet consumers' wants and needs in the sports industry and an understanding of marketing and promotion strategies utilized in various aspects of the sports industry. Examines marketing sports as a product and marketing of nonsports products using sports as a promotional tool.

**LDR 6441. Sports Media Relations. (3 Hours)**

Studies the basic knowledge and understanding of media relations in sports. Emphasizes building and managing an effective media relations program on the intercollegiate and professional level. Examines news releases, hometown features, contest management, press conferences, statistics, and publications.

**LDR 6442. Athletic Fund-Raising. (3 Hours)**

Examines the fundamental tools and strategies necessary to raise funds within college athletics. Emphasizes annual fund-raising through solicitations via the mail, telephone, and interpersonal meetings and major gift and capital campaign solicitations and presentations. Discusses the role of the annual fund within the scope of an athletics department.

**LDR 6443. Ticket Sales and Strategies. (3 Hours)**

Provides an overview of ticket sales as a revenue source in athletics. Examines sales strategies for single-game, season ticket, and group sales; ticket office operations; and building a database for ticket sales.

**LDR 6445. Corporate Sponsorships. (3 Hours)**

Offers students an opportunity to develop a complete understanding of how sports properties can create effective commercial partnerships with corporations through the creation and execution of sponsorship agreements and how to prepare and critically evaluate the strategic implications of sponsorship proposals.

**LDR 6455. NCAA Compliance. (3 Hours)**

Provides a thorough study of the governing structure, rules, and legislative process within the NCAA. Examines compliance issues within a collegiate athletic department, including drug testing, self-reporting, and student-athlete eligibility.

**LDR 6460. Risk Management in Athletics. (3 Hours)**

Offers students an opportunity to develop the tools to conduct a thorough risk assessment for their organization and events by identifying potential risks, estimating their frequency and severity, determining how to control them, and developing safety policies and processes for staff and event participants. Emphasizes how to conduct a safety review and risk assessment and how to run an event that complies with health, safety, and security regulations.

**LDR 6465. Title IX. (3 Hours)**

Examines Title IX laws governing gender equity. Emphasizes managing an athletic department within the guidelines set forth by Title IX. Examines the original Title IX legislation, subsequent regulations issued by the Office of Civil Rights, and relevant court decisions.

**LDR 6470. Bystander Strategies for the Prevention of Gender-Based Violence. (3 Hours)**

Offers participants an opportunity to learn about the theoretical and practice models used to understand and respond to gender-based violence. Emphasizes bystander models of prevention. This interactive course is designed for students who are interested in research and practice directed at youth. Explores topics such as battery, gender roles, teen dating violence, sexual harassment, sexual assault/rape, and homophobia as facets of men's violence against women. Emphasizes trainer skill development for higher education, secondary education, public health, and social professionals. Offers participants an opportunity to learn how to effectively convene and facilitate public discourse about gender-based violence utilizing mentors in violence prevention curriculum with high school and college populations and to apply these concepts in service-learning opportunities.

**LDR 6480. The Business of eSports. (3 Hours)**

Introduces students to the basic concepts and evolution of the eSports industry. Investigates and explores the use of technology and social media platforms through sports. Explores the current state of this evolving sports enterprise, including trends relating to organizations that have entered this digital space to expand their global portfolios. Incorporates industry trends with appropriate readings that offer students an opportunity to understand this emerging sports industry segment.

**LDR 6615. Academic Advising for Student-Athletes. (3 Hours)**

Offers an overview of the foundations of academic advising and life-skill training as an essential component of student-athlete success and retention programs on higher education campuses. Topics include definitions and concepts for developmental advising; literature and research on the key concepts of academic advising; exploration of the various models and delivery systems for academic advising; skills for effective advising; advising diverse populations; and training, development, evaluation, assessment, and reward systems for advisers and advising programs.

**LDR 6890. The Capstone: Demonstrating Leadership in Action 1. (2 Hours)**

Offers students a culminating experience with several opportunities to further increase their impact and effectiveness as leaders and to demonstrate their leadership expertise, knowledge, and capability. Students work in teams, with a designated sponsor, on a leadership-in-action project. Requires students to critically reflect on the experiences they have gained through the leadership program, relate those experiences to their personal experiences, refine their personal leadership models, and provide the respective sponsor with a recommended solution to the problem that has been identified.

**LDR 6895. The Capstone: Demonstrating Leadership in Action 2. (2 Hours)**

Continues LDR 6890. Offers students a culminating experience with several opportunities to further increase their impact and effectiveness as leaders and to demonstrate their leadership expertise, knowledge, and capability. Students work in teams, with a designated sponsor, on a leadership-in-action project. Requires students to critically reflect on the experiences they have gained through the leadership program, relate those experiences to their personal experiences, refine their personal leadership models, and provide the respective sponsor with a recommended solution to the problem that has been identified.

**Prerequisite(s):** LDR 6890 with a minimum grade of C-

**LDR 6961. Internship. (1-4 Hours)**

Offers students an opportunity, while under the supervision of a sports professional and utilizing relationships with local college, professional, and amateur organizations, to work on a term basis in specific sports-related assignments. Students share their experiences through a discussion board forum as well as deliver a final paper and develop a Web portfolio. The Web portfolio highlights the student's skills, knowledge, development, quality of writing, and critical thinking by showcasing a comprehensive collection of work samples and artifacts from the student's experiences in the sports leadership program. May be repeated without limit.

**LDR 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LDR 6980. Capstone. (1-4 Hours)**

Offers students an opportunity to complete their academic experience with an in-depth, sports leadership internship. Students share their experiences through a discussion board forum as well as deliver a final paper and develop a Web portfolio. The Web portfolio highlights the student's skills, knowledge, development, quality of writing, and critical thinking by showcasing a comprehensive collection of work samples and artifacts from the student's experiences in the sports leadership program. By selecting an assignment of academic and professional interest, students are offered an opportunity to deepen their knowledge of a particular area of sports leadership through the senior project option. Intended for students already employed in the sports field.

**LDR 6983. Topics. (1-4 Hours)**

Covers special topics in leadership studies. May be repeated without limit.

**LDR 6995. Project. (1-6 Hours)**

Focuses on an in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**LDR 7100. Advanced Leadership Theory, Coaching, and Development Techniques. (3 Hours)**

Explores leadership theory, coaching strategies, and development techniques. Designed for aspiring leaders and organizational consultants seeking to elevate their impact. Emphasizes evidence-based approaches, offering insights into contemporary leadership models and complex leadership challenges in diverse organizational contexts. Also emphasizes the role of coaching as a strategic tool for leadership development, focusing on advanced techniques for fostering personal growth, enhancing team performance, and driving organizational change. Explores emotional intelligence, transformative leadership, and ethical decision-making topics.

**LDR 7110. Advanced Organizational Behavior. (3 Hours)**

Presents a comprehensive view of advanced knowledge and analytical skills to address pressing issues in organizational behavior and contribute to developing effective organizational strategies. Reviews contemporary research on leadership dynamics, group behavior, organizational culture, and applications of human behavior within organizational contexts, with an emphasis on interdisciplinary perspectives. Presents case studies and empirical studies to understand the impact of individual, group, and organizational factors on performance, motivation, power dynamics, decision making, and diversity in organizations.

**LDR 7120. Global Leadership and Cultural Awareness. (3 Hours)**

Presents a comprehensive exploration of global leadership dynamics for advanced research and leadership roles in multinational organizations and international initiatives. Explores fundamental theories and practical applications underpinning effective leadership across diverse cultural contexts. Offers insight into key concepts of cross-cultural communication, multicultural team dynamics, the impact of globalization on leadership strategies, and ethical considerations in navigating cultural complexities.

**LDR 7130. Emerging Technologies in Organizational Leadership. (3 Hours)**

Explores the intersection of leadership, innovative technologies, and digital transformation shaping modern organizations. Studies the transformative effects of emerging technologies such as artificial intelligence, blockchain, Big Data analytics, and virtual and augmented reality on leadership strategies and practices. Discusses successful integration strategies and ethical considerations in technology-driven leadership.

**LDR 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**LDR 7980. The Capstone: Demonstrating Leadership in Action. (4 Hours)**

Offers students a culminating experience with several opportunities to further increase their impact and effectiveness as leaders and to demonstrate their leadership expertise, knowledge, and capability. Real-life options for the capstone experience include a leadership in action project, an Experiential Network project, and a consulting case study. Students critically reflect on the experiences they have gained through the leadership program; relate those experiences to their personal experiences; and refine their personal leadership models.

**Prerequisite(s):** LDR 6100 with a minimum grade of C- ; LDR 6120 with a minimum grade of C- ; LDR 6140 with a minimum grade of C-

## Legal Studies (LS)

### **LS 6101. Introduction to Legal Studies 1: Law and Legal Reasoning. (3 Hours)**

This course will provide students with an introduction to the American legal system and legal reasoning. The course materials will cover rights and obligations created by contracts, fundamental principles of property law, accident law, the regulation of criminal conduct, and the laws associated with business formation and relationships. Students will also complete writing exercises to enable them to synthesize their understanding, and to find and use legal sources in support of their work.

### **LS 6102. Introduction to Legal Studies 2. (3 Hours)**

This course builds on LS 6101 with its emphasis on common law by introducing students to statutes and regulations. The setting involves federal administrative agencies governing employment, consumer protection, environment, labor, cyberlaw, intellectual property, and international trade. Exercises and discussions require finding, summarizing, applying and arguing about the applicability of statutes and regulations in concrete situations. The capstone of the course allows students to create a project to illustrate the lessons learned in the course.

### **LS 6110. Law of Information and Records. (3 Hours)**

This course will present a comprehensive survey of procedural and evidentiary rules in the context of recordkeeping, document production, due diligence, and investigations. It will include an exploration of rights to privacy, issues of confidentiality and conflicts of interest, contractual and legal liability, evidentiary consequences in administrative and court settings resulting from work-place disputes, and other related areas.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

### **LS 6120. Law and Strategy. (3 Hours)**

This course will introduce students to the implications and impact of law on strategy, with attention to applying legal knowledge and resources to strategic planning and strategy implementation. The course will use several examples of readily understood strategies to provide opportunities for students to identify the legal environment, consider the legal rights and requirements implicated by relevant law or regulation (e.g., intellectual property, contracts, administrative law) and their potential impact on management, incorporating law as a resource on the resource based view of the firm. The range of examples will include considering law and strategy implementation in multiple contexts. The focus will be on developing an appreciation of the legal environment and making effective use of legal resources and lawyers as advisors in strategic management aimed at attaining sustainable competitive advantage over rivals.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

### **LS 6130. Negotiation and Advocacy. (3 Hours)**

Students will learn core elements of negotiations that are the precursors to any final agreement or resolutions of informal disputes: negotiation planning from opposing sides and counseling, analysis of the bargaining range and opponent's needs, principled concession patterns, problem-solving strategies to avoid deadlock, information bargaining and authority clarification, principles of drafting, settlement, and ethics.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

### **LS 6140. Data Regulation and Compliance. (3 Hours)**

Institutions increasingly face a host of regulatory compliance issues. This course (building on LS 6102) will cover the challenges facing organizations in building programs that ensure adherence with legal obligations, especially regarding data. We will explore statutes covering a broad range of areas, especially when it involves data protection and privacy.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

### **LS 6150. Law and Organizational Management. (3 Hours)**

Students will learn the rules governing organizations, including corporations, partnerships, governmental organizations, and non-profits. The focus will include relationships within the organizations and powers of members of organizations. In addition, the course will cover employment issues relevant to relationships in organizations. Topics will include rights of workers to be free of discrimination in the workplace, the importance of workplace rules, and policies governing the workplace.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6155. Legal Foundations of Public Policy. (3 Hours)**

Examines the legal framework for public policymaking at all levels of government. Topics include the role of law within the legislative, executive, and judicial branches of government and the contributions of local, state, and federal governments in crafting and implementing public policy. Explores the history of regulation and the rise of the administrative state. Reviews the landscape of current agency activities, including investigations and the imposition of sanctions. Introduces students to legislative and regulatory drafting processes. Offers students an opportunity to draft model legislation and participate in "notice and comment" rulemaking.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6160. Regulation and Global Business Strategies. (3 Hours)**

This course provides an introduction to the international legal concepts, principles and institutions that define and shape international business relations. Globalization has increased the number of economic interactions across national borders. The globalization of production and consumption takes place in the background of an international monetary system and an international legal infrastructure facilitating and regulating transnational trade, international finance and global intellectual property and investment protection. The course specifically examines case studies of global governance based on codes of practice, certification and other regulatory initiatives.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6170. Financial Transactions. (3 Hours)**

In this course students will explore various aspects of corporate financial transactions, including vendor and supplier contracts, early stage financing, commercial loans, initial public offerings, mergers, and the sale of assets. Issues involving valuation of assets will be covered, and students will learn basic securities laws related to the transactions covered.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6180. Health Law Survey. (3 Hours)**

This course examines legal regulations governing the provision of healthcare services. Topics include access to health insurance and healthcare, healthcare financing, the organization and responsibility of healthcare institutions (especially hospitals), healthcare cost containment policies, public and private insurance programs, and the formulation of health policy. The course will also provide an introductory overview of the major statutes, regulations, and case law related to health law, including an introduction to the Patient Protection and Affordable Care Act, otherwise known as Obamacare.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6181. Healthcare Regulation and Compliance. (3 Hours)**

This course covers major regulatory issues related to the healthcare field, providing an in-depth regulatory overview of health programs. Statutory schemes covered will include HIPAA/HITECH, Stark/fraud and abuse. In addition, students will learn about compliance programs, including compliance operations, and the code of conduct for particular fields.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6182. Patient Records, Privacy, and Security. (3 Hours)**

This course explores the ethical and legal obligations respecting patient records, particularly electronic records. In addition to reviewing HIPAA's privacy and security rules, the course will cover professional ethics regarding confidentiality, common law and state protections for confidentiality, GINA, and the HiTech Act.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6210. Special Topics in Employee Rights and Employer Obligations. (3 Hours)**

Examines the legal relationship between employer and employee. Addresses issues and topics such as discrimination, affirmative action, the Americans with Disabilities Act, sexual harassment, health and safety, AIDS in the workplace, compliance issues, and legal issues related to downsizing and terminations. Today's HR manager works in a highly complex environment with constantly changing laws and legislation that govern employee rights and employer obligations. Course content may vary from term to term.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6211. Antidiscrimination Law. (3 Hours)**

This course will provide an overview of antidiscrimination laws governing the workplace. The focus will be on discrimination based on race and sex, but some attention will also be given to discrimination based on other characteristics, including age, sexual orientation, and disability. In addition to general issues of discrimination, the course will focus on the specific topics of retaliation, harassment, and bullying in the workplace.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6212. Wages and Benefits. (3 Hours)**

This course will cover topics related to wage and hour laws (federal and state), ERISA (pensions), health insurance benefits, the Affordable Care Act, and disability insurance.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6230. Intellectual Property Survey. (3 Hours)**

In our modern day "information economy," the law of intellectual property (IP) has taken on enormous importance to both creators and users of creative works. Such IP Law is the way we provide legal protection to encourage invention and creativity by guaranteeing an opportunity for financial return to the originator of novel work. This course introduces students to the classic principles of copyright, patent, trademark, and trade secret law and explores the ways in which those principles are shifting and adapting in response to new technology.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6231. Identifying and Securing Intellectual Property Rights. (3 Hours)**

This course will focus on intellectual property issues in employment, collaborative environments, and business transactions. It will cover common issues for founders and startups, employers, and contractors—including non-compete agreements, crowd-sourcing, and open innovation practices.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6232. Intellectual Property and Media. (3 Hours)**

This course will cover copyrights, trademarks, and unfair competition, with a focus on media, advertising, user-generated content, and other online activities.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6235. Current Issues in Law and Public Policy. (3 Hours)**

Examines the evolving roles of courts, agencies, legislatures, citizen movements, and nonprofit organizations in policymaking through case studies of current debates in law and policy. Explores how businesses and advocacy groups combine the use of legal tools and other activities to achieve policy goals. Considers how law can be used to right past wrongs and how grassroots activities and individual actions can contribute to a fight against injustice. Focuses on a range of policy issues; possible topics include but are not limited to healthcare reform, criminal justice reform, racial justice, reproductive rights, marriage equality, and environmental justice.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6236. Contract Drafting. (3 Hours)**

Examines strategies, objectives, and challenges of drafting contracts. Develops skills drafting contracts and factors influencing drafting style, technique, and content. Students dissect and examine a range of contracts encountered in business relationships, such as license agreements, employment agreements, real estate transactions, litigation settlements, and purchase and sale agreements. Students evaluate, explore, and interpret drafting techniques and decisions in varied contexts. Class exercises help students draft and analyze various contracts of increasing complexity.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6237. Insurance Law. (3 Hours)**

Offers a comprehensive overview of the fundamental principles, regulations, and practical applications of insurance law. Examines the foundations of insurance law; types of insurance policies and coverages; policy language interpretation; and how certain statutes, regulations and case law have shaped modern insurance law. Emphasizes the interplay between insurance law and tort law.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6238. Regulating Artificial Intelligence. (3 Hours)**

Examines the regulatory landscape of artificial intelligence technologies on a global scale by exposing students to the legal, ethical, and policy challenges posed by AI's rapid advancement. Uses readings, case studies, debates, and interactive discussions to offer students an opportunity to develop knowledge of the various regulatory approaches, international collaborations, geopolitical significances, and potential future directions of AI governance.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**LS 6239. Sports Law, Business, and Society. (3 Hours)**

Explores the unique set of legal, business, and social structures that intersect with sports in the United States. Examines the professional, collegiate, and amateur sports industry and its key legal, business, and social aspects. Covers the foundations of intellectual property law, labor law, antitrust law, employment law, agency law, constitutional law, broadcasting law, and private association law in relationship to the sports industry. Studies the business applications of the sports industry and the industry's relationship to antidiscrimination laws concerning race, sex, national origin, and other protected classes. Examines pursuits of careers in sports law and sports business. Offers students an opportunity to debate underlying principles and rethink the ethical boundaries that surround the sports industry.

**Prerequisite(s):** LS 6101 with a minimum grade of C- or LS 6102 with a minimum grade of C-

**Liberal Studies - CPS (LST)**

**LST 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LST 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LST 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LST 4850. Capstone Project in Liberal Studies. (3 Hours)**

Offers students an opportunity to complete an independent capstone research project, with faculty supervision and guidance, that addresses a research question in line with the student's curriculum plan.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**LST 4950. Seminar. (1-4 Hours)**

Offers an in-depth study of selected topics.

**LST 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**LST 4983. Topics. (1-4 Hours)**

Covers special topics in liberal studies. May be repeated without limit.

**LST 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LST 4991. Research. (1-4 Hours)**

Offers students an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**LST 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic.

**LST 4994. Internship. (1-4 Hours)**

Provides students with an opportunity for internship work.

**Attribute(s):** NUpath Integration Experience

**LST 4995. Practicum. (1-4 Hours)**

Provides eligible students with an opportunity for practical experience.

**LST 4996. Experiential Education Directed Study. (1-4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major.

**Attribute(s):** NUpath Integration Experience

**LST 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Linguistics (LING)

**LING 1000. Linguistics at Northeastern. (1 Hour)**

Introduces first-year linguistics majors to the discipline, the department, and the University as a whole; offers students an opportunity to familiarize themselves with the skills needed for success as a university student.

**LING 1150. Introduction to Linguistics. (4 Hours)**

Explores linguistics, the scientific study of language. Major topics include phonetics, the production of speech sounds; phonology, sound systems in languages; morphology, the structure of words; syntax, grammatical relationships between words and sentences; and semantics, the meaning of words and sentences. Other topics that may be surveyed include the relationship between language and culture, language use within speech communities, languages in contact, change in language over time, first language acquisition, brain and language, and animal communication.

**Attribute(s):** NUpath Natural/Designed World, NUpath Societies/Institutions

**LING 1449. English Now and Then. (4 Hours)**

Introduces the field of linguistics from current and historical perspectives. Covers the scientific study of language: phonetics (production of speech sounds), phonology (sound systems in languages), morphology (structure of words), syntax (grammatical relationships between words and sentences), and semantics (meaning of words and sentences). These linguistic structures provide the basis for exploring the origins and development of the English language. Emphasizes both the major structural changes English has experienced over time, as well as the sociohistorical contexts that gave rise to these changes.

**Attribute(s):** NUpath Interpreting Culture, NUpath Natural/Designed World

**LING 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LING 2350. Linguistic Analysis. (4 Hours)**

Builds on the foundations of linguistic analysis developed in LING 1150. Offers students an opportunity to obtain a foundational basis for future study by focusing on four core areas of linguistics: phonetics, phonology, morphology, and syntax. Students hone their analytic abilities as they work with increasingly complex datasets. Adopting a descriptive, nontheoretical approach, students conduct linguistic research through a semester-long analysis of a world language.

**Prerequisite(s):** LING 1449 with a minimum grade of D- or LING 1150 with a minimum grade of D-

**LING 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LING 3150. Field Linguistics. (4 Hours)**

Exposes students to the basic techniques of field methods with the goal of reinforcing the fundamental skills used in linguistic analysis. Through readings, discussions, and practical experience, students explore best practices in conducting linguistic field work: working with a native speaker consultant, eliciting linguistic structures, managing data effectively, analyzing the data collected, and presenting findings formally. May be repeated two times.

**Prerequisite(s):** LING 1449 with a minimum grade of D- or LING 1150 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Integration Experience

**LING 3250. Discourse Analysis. (4 Hours)**

Introduces approaches to the analysis of interpersonal and institutional discourse and offers multiple opportunities to carry out small-scale analyses of talk-in-interaction. Major topics include conversational involvement and inference, conversation analysis, intertextuality, linguistic politeness, conversational style, framing, positioning, identity construction, epistemics, and conversations within institutional contexts.

**Prerequisite(s):** LING 1150 with a minimum grade of D- or LING 1449 with a minimum grade of D-

**LING 3412. Language and Culture. (4 Hours)**

Explores the complex, often inexplicit relationship between language and culture, using a variety of methods drawn from the fields of anthropological linguistics and sociolinguistics. Questions may include: How do language and thought interact? How is language used to create and maintain social institutions and individual personae? How is language used differently by and across gender, ethnicity, and social class?.

**Prerequisite(s):** (LING 1449 with a minimum grade of D- or ENGL 1150 with a minimum grade of D- or LING 1150 with a minimum grade of D- ); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture, NUpath Writing Intensive

**LING 3420. Phonetics. (4 Hours)**

Surveys phonetics, the study of speech sounds, including articulatory, acoustic, and auditory phonetics. Articulatory phonetics topics include anatomy and physiology; cross-linguistic consonant and vowel articulation; aerodynamics of speech production; coarticulation phenomena; and phonetics of supersegments such as syllables, stress, tone, and pitch accent. Acoustic phonetics topics include the physics of sound waves, reading spectrograms, and performing acoustic analyses. Auditory phonetics topics include audition and speech perception.

**Prerequisite(s):** LING 2350 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**LING 3422. Phonology. (4 Hours)**

Examines phonology, the study of the mental representation, organization, and patterning of sounds in human language. Major topics include phonological typology, phonemes, underlying and surface representations, phonological rules and alternations, natural classes of sounds, syllables and prosody, autosegmental phonology, rule-based vs. constraint-based approaches, morphophonology, diachronic phonology, and current theoretic models of sound systems.

**Prerequisite(s):** LING 2350 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**LING 3424. Morphology. (4 Hours)**

Introduces morphology, the study of the structure, distributional behavior, and use of words. Covers descriptive methods of analysis, hierarchical word structure, morphological processes and rules, productivity, morphological change, and the interaction of morphology with phonology and syntax. Introduces major contemporary theories, including split morphology and single-component architecture.

**Prerequisite(s):** LING 2350 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**LING 3440. Language Acquisition. (4 Hours)**

Examines the milestones and developmental patterns of typical first language acquisition across the linguistic system. Details the patterns and expected norms for the acquisition and development of speech perception and production, semantics, morphosyntax, pragmatics, and the lexicon. Considers biological, environmental, linguistic, and other factors that contribute to the processes of language acquisition, as well as major theories in the field. Students gain hands-on experience transcribing, analyzing, and evaluating child language data throughout the semester.

**Prerequisite(s):** LING 1449 with a minimum grade of D- or LING 1150 with a minimum grade of D-

**LING 3442. Sociolinguistics. (4 Hours)**

Focuses on why people choose to say things in different ways in different situations. Examines language behavior in its social context and outlines the linguistic constructs that allow conversation to occur, the types of variation that can occur in registers and dialects, and the possible reasons for choosing different linguistic varieties. Also explores linguistic variation in relation to social context, gender, socioeconomic class, race, and ethnicity.

**Prerequisite(s):** (ENGL 1150 with a minimum grade of D- or LING 1449 with a minimum grade of D- or LING 1150 with a minimum grade of D- ); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions, NUpath Writing Intensive

**LING 3446. Language Endangerment and Vitality. (4 Hours)**

Examines the sociolinguistics of endangered languages. Major topics include global language vitality, language endangerment, ethnography, language death and its relation to loss of cultural identity within communities, and language planning and policy. Discusses these topics theoretically and in cross-linguistic perspective by examining various case studies.

**Prerequisite(s):** LING 1449 with a minimum grade of D- or LING 1150 with a minimum grade of D-

**LING 3450. Syntax. (4 Hours)**

Introduces syntax, the theory of sentence structure. Explores how to do syntactic analysis using linguistic evidence and argumentation. Focuses primarily on English, with some discussion on the syntax of other languages. Other topics include syntactic universals and the relation between syntax and semantics.

**Prerequisite(s):** LING 2350 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**LING 3452. Semantics. (4 Hours)**

Focuses on meaning and how it is expressed in language—through words, sentence structure, intonation, stress patterns, and speech acts. Considers how content, logic, and speakers' and listeners' assumptions affect what sentences can mean and how linguistic meaning is determined by one's perceptual system or culture.

**Prerequisite(s):** LING 1449 with a minimum grade of D- or LING 1150 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**LING 3454. History of English. (4 Hours)**

Surveys the linguistic and social history of the English language from its Indo-European beginnings to the present. Examines the changes that have occurred in the sound system, word and sentence structures, vocabulary, semantics, and spelling from a formal linguistic perspective. Considers issues in language change—the influence of foreign invasion and migration, differences in dialect, and the emergence of English as a “world” language.

**Prerequisite(s):** LING 1449 with a minimum grade of D- or LING 1150 with a minimum grade of D-

**LING 3456. Language and Gender. (4 Hours)**

Investigates the relationship between language and gender. Topics include how men and women talk; the significant differences and similarities in how they talk, why men and women talk in these ways, and social biases in the structure of language itself.

**Prerequisite(s):** (LING 1449 with a minimum grade of D- or LING 1150 with a minimum grade of D- ); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions, NUpath Writing Intensive

**LING 3460. Historical Linguistics. (4 Hours)**

Introduces diachronic linguistics, the study of language change over time. Surveys common changes in the areas of sound systems, word and sentence structure, and semantic meaning. Introduces methodologies to access earlier stages of language, including the comparative method and internal reconstruction. Other topics include linguistic borrowing, analogical change, linguistic paleontology, and areal diffusion.

**Prerequisite(s):** LING 2350 with a minimum grade of D-

**LING 3462. Constructed Languages. (4 Hours)**

Focuses on constructed languages (conlangs): linguistic systems that have emerged from conscious creation, rather than natural development. Surveys a number of well-known conlangs. Examines the motivations for their creation, their internal linguistic structures, and their status and effectiveness within the cultures (real or fictional) for which they were designed. Building on their knowledge of linguistic structure, offers students an opportunity to develop their own constructed languages.

**Prerequisite(s):** LING 2350 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**LING 3550. Syntax 2. (4 Hours)**

Introduces topics in advanced syntax, building on students' knowledge of basic concepts in phrase and sentence structure. Explores a wide range of complex syntactic constructions, and considers how current theory can be applied to numerous cross-linguistic syntactic phenomena.

**Prerequisite(s):** LING 3450 with a minimum grade of D-

**LING 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LING 4654. Seminar in Linguistics. (4 Hours)**

Explores a topic in current linguistics research. Requires prior completion of either two 3000-level LING courses or one 3000-level LING course and permission of instructor. May be repeated without limit.

**Prerequisite(s):** LING 2350 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**LING 4891. Research Seminar in Linguistics. (4 Hours)**

Offers individualized research experience on a chosen topic under the direction of a faculty member. Also includes group meetings of students and the faculty member to study relevant research methods, to discuss relevant research literature, and to present research progress and results. Research content and requisites depend on the instructor, and prior arrangements should be made with the faculty member well in advance of registration. May be repeated up to eight times.

**Attribute(s):** NUpath Integration Experience

**LING 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**LING 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** LING 4970 with a minimum grade of D-

**LING 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**LING 4991. Directed Study Research. (4 Hours)**

Offers individualized research experience on a chosen topic under the direction of a faculty member. Research content and requisites depend on the instructor, and prior arrangements should be made with the faculty member well in advance of registration.

**Attribute(s):** NUpath Integration Experience

**LING 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated twice.

**LING 4996. Experiential Education Directed Study. (4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major. Fulfills the college's experiential education requirement. May be repeated without limit.

Attribute(s): NUpath Integration Experience

**Management (MGMT)****MGMT 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGMT 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGMT 3302. Negotiating in Business. (4 Hours)**

Focuses on the nature of conflict, conflict resolution, and the structure and process of negotiations, negotiation ethics, as well as skills to deal with "difficult" negotiators. Negotiation is a lifelong skill that we use every day, not just a tactic to get a higher salary or a better deal. No matter what direction one's professional life takes, negotiation is an essential part of one's job and one's life. To be effective, one must be a skillful negotiator. While some of us are naturally gifted negotiators, most of us are not; the concepts and techniques of skillful negotiations can be learned and practiced in the classroom. Offers students numerous opportunities to develop and practice negotiating skills.

**MGMT 3305. Power and Influence. (4 Hours)**

Offers students an opportunity to learn how to use power and influence as effective tools for understanding their work surroundings, working with and managing people, and achieving their own professional goals. Studies conceptual models, tactical approaches, and practical tools to help make sense of on-the-job learning experiences. Seeks to equip students with basic diagnostic and action-planning skills that can be used to understand power dynamics unfolding in any organization, as well as how best to leverage these dynamics. Previous work experience (e.g., part-time job or co-op) is recommended but not required for enrollment in the course.

**MGMT 3315. Managing Organizational Change and Disruption. (4 Hours)**

Covers fundamentals of change leadership as a set of integrated skills, focusing on examples of both proactive change (leveraging opportunities to grow and improve), as well as reactive change (leading in times of crisis). Uses case studies, media coverage, simulations, and guest speakers to examine some of the most dramatic changes encountered by business leaders in recent times and to evaluate different approaches to managing change at all levels of the organization. Examines the psychology of change, including overcoming fear of and resistance to change, and introduces practical frameworks that students can leverage in their own change efforts. Requires a student-led change project.

**MGMT 3340. Healthcare Management, Innovation, and Design. (4 Hours)**

Offers an overview of key U.S. health system components and imperatives and how to manage and innovate within the system to improve performance and the customer experience. Designed for students interested in healthcare careers that may have meaningful managerial, analytical, or consulting-type responsibilities. Covers essential elements of how healthcare delivery is organized and delivered; how to implement change and innovation in healthcare organizations such as hospitals and physician offices; and the interrelationships between facets of the business such as the drive for value and efficiency, promoting high-quality care, and enhancing the patient experience. Analyzes and critiques cutting-edge changes in the industry. Offers students an opportunity to learn about and use skills in process improvement, performance management, talent management, quality improvement, and work redesign.

**MGMT 3350. Managing a Diverse Workforce. (4 Hours)**

Examines issues related to managing oneself and others in an increasingly diverse workforce. Organizations need to address diversity issues in some manner if they are to compete effectively in a global economy. Covers diversity-related issues with management implications including religion, social identity, socialization, employment decisions by applicants and organizations, team dynamics, leadership, sexual harassment, workplace romance, career development, work and family, accommodation of people with disabilities, and organizational strategies for promoting equal opportunity and a multicultural approach toward diversity. Offers students an opportunity to conduct self-assessments to monitor their own workforce needs as they relate to issues of diversity, careers, and work-life integration.

**MGMT 3380. Leadership. (4 Hours)**

Designed to help develop students' leadership skills and prepare themselves to lead with integrity. Uses discussion, case studies, exercises, and video/audio to explore both the science and the art of leadership. Topics include leadership theories, power and politics, counseling, communication, and followership. Additionally, this class includes a heavy focus on ethical philosophy and its application to leadership.

**Prerequisite(s):** COOP 3945 with a minimum grade of S or COOP 3948 with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S

**MGMT 3420. Managing Human Capital. (4 Hours)**

Offers an overview of the human resources management (HRM) function, including recruiting and hiring new employees, overseeing compensation and benefits, improving employee relations, and ensuring compliance with labor laws. Focuses on what a (non-HRM) manager needs to know about HRM and also seeks to provide a foundation for the HRM professional.

**MGMT 3435. Social Networks and Organizations. (4 Hours)**

Introduces students to social network analysis. Identifies and evaluates key elements of an individual's social network—including students' own networks—and familiarizes students with some tools and techniques for managing organizational networks. Examines different types and combinations of social relations, network structures of these relations, and institutional environments that impact them. The course combines lectures, case-based class discussions, and personal/organizational network analysis applications.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**MGMT 3530. Project Management. (4 Hours)**

Discusses why good project management skills are essential to a wide variety of business careers. Covers why many important business projects fail due to poor planning, poor time management, going over budget, and/or ineffective communication. Includes a balance of strategic, technical, and behavioral issues in project management.

**MGMT 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGMT 4310. The Management Practices of Great Organizations. (4 Hours)**

Focuses on a wide range of management practices, many of which are "radical" and represent organizations that "dare to be different." The course uses many teaching approaches, including case studies, class exercises, and "competitions" that require students—and seek to increase their ability—to debate, present, think on their feet, and ask tough questions. Some organizations seem "to work"; they provide high-quality products and services, they treat their employees with respect, they behave ethically, they are strong financially, and the like. Students study and debate the criteria for a great organization in order to answer the key question of this course: how do they do it; i.e., why do they work so well?.

**MGMT 4410. Workforce Analytics. (4 Hours)**

Introduces workforce analytics, including identifying the strategic work that is truly necessary to execute strategy, investing in differentiated management systems that support that work, and designing and implementing targeted measurement systems for strategic talent. Emphasizes shifting from levels or metrics (e.g., what is our cost per hire?) to analytics and impact (e.g., how might an increase in the quality of our project managers affect new product cycle time?). Relevant for students specializing in corporate finance, management, marketing, and international business. Many firms spend over 50 percent of their revenues on the workforce, but these investments are rarely well measured or managed.

**MGMT 4550. Management Consulting in Organizations. (4 Hours)**

Offers students an opportunity to gain practical experience in finding appropriate solutions for complex and dynamic client organizational issues using a structured curriculum and frequent in-class coaching sessions. Students work as pro bono consultants both onsite and virtually with organizations to help solve real client challenges in the managing and leading of an organization. Students employ management consulting as a framework in demonstrating proficiency in a wide range of knowledge and skill areas in both management and consulting. Structures course deliverables as challenging goals to be achieved within a set time frame by working with students' chosen consulting (Pod) group and through individual assignments.

**Prerequisite(s):** COOP 3945 (may be taken concurrently) with a minimum grade of S or COOP 3948 (may be taken concurrently) with a minimum grade of S

**MGMT 4983. Special Topics in Management. (4 Hours)**

Offers special topics in management. May be repeated once.

**MGMT 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGMT 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of faculty members of the department on a chosen topic. Course content depends on instructor. May be repeated up to four times for a maximum of 8 semester hours.

**MGMT 6211. Business Law and Professional Ethics. (2 Hours)**

Examines the critical aspects of business essential in understanding the business and legal environment. Examines contract law and areas of the law that relate directly to the accountancy profession. Develops knowledge of the Uniform Commercial Code as it relates to the law of sales, commercial paper, and secured transactions. Also explores the importance of ethics in the business and accounting environment, and considers potential ethical dilemmas.

**MGMT 6213. Managing Ethics in the Workplace and Marketplace. (3 Hours)**

Offers practical guidance for improved decision making in business situations involving critical ethical issues, to stimulate creative and constructive thinking and learning for working professionals. Combines didactic instruction and a series of case studies, readings, and field study experiences to demonstrate how to assign ethical problems into categories and approach the problems using standard tools and techniques to be applied when working under conditions of uncertainty. Reexamines ideas about ethics and offers opportunity for students to reflect on their sense of moral suasion. Instructs how to identify what constitutes an ethical problem and how to view ethical issues as signposts for attention and not as impediments to moving forward.

**MGMT 6214. Negotiations. (2,3 Hours)**

Designed to improve students' understanding of the negotiations process and their ability to plan and conduct negotiations effectively. Includes such class activities as readings, lectures, and discussions as well as case discussions and role-playing negotiation exercises.

**MGMT 6222. Healthcare Industry. (3 Hours)**

Examines the evolution of the U.S. healthcare delivery system from early forms of organized institutional care through the current dynamic and increasingly integrated and managed care systems. Introduces students to the interactions of regulatory, economic, political, and social aspects of the healthcare system. Compares current policies and proposals for health reform. Students are asked to analyze the impact and consequences of actions in one era on the structure and function of healthcare practice in later years and to project these trends into the future.

**MGMT 6223. Strategic Decision Making for Healthcare Professionals. (3 Hours)**

Examines how healthcare organizations manage their resources and competitive environment to meet the goals of their many stakeholders. Applies three essential elements of strategic decision making—environmental analysis, strategic formulation, and strategy implementation—to the healthcare industry.

**MGMT 6225. Sustainability and Leadership. (3 Hours)**

Examines how organizational leaders influence decisions to advance an environmental agenda. Studies the scientific knowledge that organizational leaders must have to make effective sustainability decisions. Analyzes how a variety of organizations, including businesses, governments, government-sponsored enterprises, and nongovernment organizations, interact on environmental issues.

**MGMT 6226. Sustainability and the Business Environment. (3 Hours)**

Examines how the environment affects corporate strategy, public policy, and individual decision making. Exposes students to the skills and knowledge needed to help organizations understand and act upon the principles of sustainability. Examines a variety of environmental problems, including global warming, use and disposal of toxic substances, and depletion of natural resources. Also studies how companies solve these problems by reducing their impact on the environment through solutions such as zero emissions, green design, and corporate environmental reporting.

**MGMT 6413. Managing Ethics in the Workplace and Marketplace. (4 Hours)**

Offers students an opportunity to build a personal framework for managing ethics throughout their business lives. Introduces students to fundamental philosophical concepts with which to critically examine and verbalize the kind of life and career they wish to lead. Explores practical strategies informed by behavioral science that students can harness to help realize their vision of the good life. Considers current controversies in business to examine arguments for and against the morality of a variety of market institutions and practices. Designed to position students to critically assess role responsibilities in business within dynamic, contested, imperfect, and sometimes corrupt institutions.

**MGMT 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGMT 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

**Management - CPS (MGT)****MGT 1100. Introduction to Business. (3 Hours)**

Offers students an opportunity to develop a business vocabulary, refine business decision-making skills, and foster critical and analytical thinking. Examines key external factors that influence business development, namely political, economic, legal, social, and technological forces. Explores the internal organization of business, analyzing major issues associated with the key management functions of marketing, strategy, finance, accounting, information systems, and operations.

**MGT 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGT 2100. Principles of Management. (3 Hours)**

Examines historical changes in workforce composition and the many effects of globalization, technological change, and new workforce arrangements. Offers students an opportunity to apply critical thinking to topics related to the managerial tasks of planning, organizing, leading, and controlling. Emphasizes discussions on diversity in organizations, social responsibility, managerial ethics, and the impact of globalization.

**Prerequisite(s):** MGT 1100 with a minimum grade of D- or CMN 1100 with a minimum grade of D- or CMN 1103 with a minimum grade of D- or CMN 2210 with a minimum grade of D- or HMG 1100 with a minimum grade of D-

**MGT 2210. Information within the Enterprise. (3 Hours)**

Addresses the central role of information management (IM) and information technology (IT) systems in running and managing a business and in infusing it with competitive advantage. Business leaders must have ready access to timely, accurate, and relevant information if they are to manage and compete effectively in the global economy. Explores how a wide range of enterprises around the world employ IM to operate, to manage and control, and to plan and innovate. Focuses on real business issues, analysis and problem solving, and out-of-the-box thinking in creating value to the enterprise by effectively applying IM and IT. Rather than focusing on specific technical content or skills, this course is entirely case driven.

**Prerequisite(s):** ITC 1000 with a minimum grade of D- or ITC 2016 with a minimum grade of D-

**MGT 2220. Supply Chain Management. (3 Hours)**

Explores the basic concepts of managing a supply chain that produces goods and/or services. Offers students an opportunity to examine the fundamental functions and processes of a fully integrated supply chain, identify the key business and economic drivers of supply chain performance, and understand the strategic decisions that enable a supply chain to directly support business objectives. Topics include basic functions within a supply chain—planning, sourcing, forecasting and demand planning, manufacturing, inventory management, logistics, just-in-time (JIT), lean, Six Sigma, outsourcing, and sustainability.

**Prerequisite(s):** AVM 1150 with a minimum grade of D- or MGT 1100 with a minimum grade of D-

**MGT 2310. Organizational Behavior. (3 Hours)**

Studies psychological, sociological, and organizational theories and principles underlying interpersonal communication in the organization. Through written analysis of case studies and role-playing, offers students an opportunity to analyze the impact of varying organizational decisions and dynamics on employee and management behavior. Discusses how embracing human differences and implementing diversity initiatives contribute to both organizational performance and the advancement of the society as a whole.

**Prerequisite(s):** HMG 1100 with a minimum grade of D- or MGT 1100 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity

**MGT 2330. Business Law. (3 Hours)**

Introduces the foundations and principles of American legal jurisprudence and aspects of the legal environment that impact business executives. Begins with an overview of the court system, litigation, and the U.S. Constitution. Emphasizes the roles of contract law, tort law, criminal law, and property rights in business. Focuses on the legal organization and operation of business entities such as corporations, limited liability companies, and partnerships, including corporate governance models, board of director liability, shareholder conflicts, proxy contests, and stakeholder rights. Special topics affecting business include intellectual property, employment laws, discrimination in the workplace, international law, and securities regulations.

**MGT 2550. Sustainable Entrepreneurship. (3 Hours)**

Seeks to help students assess the organizational benefits and the social implications of developing sustainable business models, starting from a definition of what a social enterprise is and how it differs from other types of business. Covers recent theories and frameworks on social and sustainable entrepreneurship, exploring best practices and case studies of purpose-driven companies. Offers students an opportunity to apply entrepreneurial business principles to provide social benefits in areas such as the environment, workforce development, education, health, community, and international development. Students develop a sustainable business idea by identifying challenges and opportunities and applying ethical reasoning needed to make business safer, fairer, and more positively impactful.

**Prerequisite(s):** MGT 1100 with a minimum grade of D-

**MGT 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGT 3220. International Business. (3 Hours)**

Focuses on the principles and practices of international business, comparing domestic and international activities and managerial responsibilities. Examines the major facets of the international management environment (legal, political, economic, and cultural). Explores international strategies by assessing the main factors determining success and failure of international companies. Offers students an opportunity to describe and compare domestic and international management operations and issues such as managing a multicultural workforce, designing and executing global marketing strategies, designing global products and services, and managing global R&D.

**Prerequisite(s):** MGT 2100 with a minimum grade of D- or MGT 2310 with a minimum grade of D- or CMN 3050 with a minimum grade of D- or LDR 1501 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**MGT 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGT 4210. Project Management. (3 Hours)**

Focuses both on the analytical tools to manage projects as well as the people-management tools necessary for project success. Examines the entire process of implementing a project, from project definition to the evaluation of feasibility, scheduling, quality criteria, and financial and budgetary factors. Offers students an opportunity to apply contemporary management techniques based on Project Management Institute (PMI) current practices and to become familiar with current software options.

**Prerequisite(s):** MGT 2100 with a minimum grade of D- or MGT 2310 with a minimum grade of D- or CMN 3050 with a minimum grade of D- or LDR 1501 with a minimum grade of D-

**MGT 4220. Innovation and Change Management. (3 Hours)**

Offers students an opportunity to discuss and apply principles, tools, and methods to successfully implement change and innovation within organizations. The use of multiple perspectives to assess organizational performance seeks to ensure that students are not trapped by a “one-best-way” approach to change management. Discusses strategies to design, implement, communicate, and sustain change; techniques for mapping and assessing when and where change is needed in an organization; organizational development techniques; as well as barriers and enablers to fostering an environment conducive to change and innovation.

**Prerequisite(s):** MGT 4210 with a minimum grade of D- or (PJM 1100 with a minimum grade of D- ; PJM 1400 with a minimum grade of D- )

**MGT 4230. New Venture Creation. (3 Hours)**

Examines the theory and practice of developing and managing innovations in startups and in already established firms. Offers students an opportunity to apply frameworks, strategies, business models, idea-generation techniques, and funding methods for introducing new products and services. Examines such topics as the creative process, the formulation of a business plan, and the execution of the plan itself.

**Prerequisite(s):** ENG 3107 with a minimum grade of D- ; ENG 3108 with a minimum grade of S ; ((MGT 1100 with a minimum grade of D- ; MGT 2310 with a minimum grade of D- ) or (PJM 1100 with a minimum grade of D- ; PJM 1400 with a minimum grade of D- ) or MGT 4210 with a minimum grade of D- )

**Attribute(s):** NUpath Creative Express/Innov, NUpath Writing Intensive

**MGT 4850. Business Strategy. (4 Hours)**

Examines how companies in different industries choose goals and strategically position themselves in the business environment. Examines the total management process from planning to execution. Offers students an opportunity to critically reflect about issues, including long-term planning, corporate social responsibility, diversification, and building dynamic capabilities through the application of strategic frameworks. As a capstone course, it relies on and combines skills from several business disciplines—marketing, finance and accounting, organizational behavior, operations, and management information systems.

**Prerequisite(s):** MGT 2310 with a minimum grade of D- ; ENG 3107 with a minimum grade of C ; ENG 3108 with a minimum grade of S

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**MGT 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student’s major field. May be repeated without limit.

**MGT 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGT 4995. Experiential Management Practicum. (3 Hours)**

Offers students an opportunity to test-drive a potential career, acquire marketable skills, and practice typical obligations of the professional work environment. Students apply knowledge and skills gained through their management degree program to work on challenging short-term projects under faculty supervision. Students are matched with discipline-specific consulting projects provided by a wide range of sponsoring organizations in the private and nonprofit sectors. Examples of projects include developing a project plan, conducting market research, and developing and delivering managerial recommendations to sponsoring organizations. Requires an application process through the experiential network platform.

**Management Information Systems (MISM)****MISM 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MISM 2301. Introduction to Information Systems and Digital Technologies. (4 Hours)**

Examines the strategic role of information systems in the enterprise and the functions, advantages, impacts, and risks that organization faces when they evaluate, implement, utilize, and upgrade modern technologies and platforms. Provides in-depth understanding about the nature of digital and disruptive technologies and how they are used to solve problems. Also discusses how information systems and information technologies are leveraged to gather and analyze data to create new uses. Explores the use of frameworks to analyze business situations and of productive software to tackle data analyses.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Ethical Reasoning

**MISM 2420. Foundations of Business Analysis. (4 Hours)**

Introduces skills and techniques that business analysts use during project processes. Business analysis is the practice of enabling change in organizations by framing problems, defining needs, understanding stakeholders, and recommending solutions that deliver value to customers and/or stakeholders. Offers students an opportunity to develop knowledge and business analysis skills such as planning, eliciting, communicating, analyzing, validating, and managing requirements. These practices enable business analysts to effectively contribute in teams that are charged with the implementation of product, process, technology, or strategic change.

**Prerequisite(s):** MISM 2301 with a minimum grade of D-

**MISM 2510. Fundamentals of Information Analytics. (4 Hours)**

Focuses on information analytics concepts and techniques needed by educated information analysts, designers, and consumers to lead organizations in the contemporary information age. Includes concepts, techniques, methods, and strategies for the entire information life cycle—collection, organization, exploration, analysis, manipulation, visualization, interpretation, and presentation of information for business. Each of these topics is introduced with real-world examples and data sets, grounded in relevant theory and principles, and is reinforced using various user-friendly software tools to gain the necessary analytical skills and knowledge.

**MISM 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MISM 3205. Redesigning Business Models with Automated and Autonomous Technologies. (4 Hours)**

Explores both concepts and practical applications of automated and autonomous technologies in business. Focuses on how organizations use such technologies to improve, redesign, or radically change existing business models. Examines how Big Data, Internet of Things, generative AI, biometrics, machine learning, automation, natural language processing, cloud computing, and gig platforms contribute capabilities to automated and autonomous technologies that transform business models. Through information technology consulting and information systems analysis lenses, offers students an opportunity to learn to identify opportunities, risks, benefits, costs, and trade-offs of leveraging these technologies to deliver value to customers.

**Prerequisite(s):** MISM 2301 with a minimum grade of D-

**MISM 3403. Data Management for Business. (4 Hours)**

Offers students an introduction to and overview of the methodological frameworks and tool sets for the design, development, and implementation of data-management solutions. Today, almost no aspect of business operates without a strong reliance on the flow of information. Even small enterprises track huge volumes of data, from sales transactions and supply chain activities to Web site traffic. Knowledge workers and managers at all levels within the organization require an understanding of data management, database design and operations, and associated decision-support and data-analysis tools and systems to complete even day-to-day tasks. Offers students an opportunity to work hands-on, applying these methods and tools to solve actual business problems.

**MISM 3405. Data Wrangling for Business Analytics. (4 Hours)**

Covers data wrangling principles and novel techniques for business analytics. Key topics include data profiling, data retrieval, data cleansing, and data integration, as well as data extraction and exploration via APIs. Applies the principles of data wrangling for structured and unstructured data using industry tools such as Oracle, SQL, statistical programming languages (R/Python), and visualization tools (Tableau). Offers students an opportunity to learn data wrangling techniques to identify and solve real-world data challenges, creating business value from the vast amount and types of traditional and big data.

**MISM 3460. Web Design and Development for Business. (4 Hours)**

Introduces web design and development with a focus on client-side technologies. Covers topics such as website evaluation and analysis, website design, website development, content management systems, and website hosting. Uses hands-on projects to explore HTML5, CSS, JavaScript, and modern frameworks to support client-side web development. Also discusses the structure of dynamic, data driven, and interactive web applications and covers the characteristics of mobile apps/mobile-first websites.

**Prerequisite(s):** MISM 2301 with a minimum grade of D-

**MISM 3501. Information Visualization for Business. (4 Hours)**

Introduces the use of design, interaction, and visualization techniques and strategies to support the effective presentation and manipulation of business information. Based on principles from art, design, psychology, and information science, offers students opportunities to learn how to successfully choose appropriate methods of representing various kinds of business data to support analysis, decision making, and communication to organizational stakeholders.

**MISM 3515. Data Mining for Business. (4 Hours)**

Covers key concepts, techniques, methods, and applications of data mining in the context of business. Offers students opportunities to learn how to distill key insights from a large amount of unknown data, which techniques to choose from, how to apply the techniques and methods to get the answer and insights from the data, and how to interpret the results from the analysis. Example predictive analysis techniques include market basket analysis and principle component analysis. Covers all techniques using business examples and user-friendly tools.

**Prerequisite(s):** MGSC 2301 with a minimum grade of D- or ECON 2350 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or POLS 2400 with a minimum grade of D- or IE 4512 with a minimum grade of D-

**MISM 3525. Modeling for Business Analytics. (4 Hours)**

Focuses on modern decision models in business analytics with applications to business process design, revenue management, pricing, inventory control, business network planning, and other topics. Introduces concepts including optimization, dynamic programming, cluster analysis, and consumer choice models. Emphasizes data-driven, real-world applications of the mathematical decision tools and concepts presented in the course.

**Prerequisite(s):** COMM 2301 with a minimum grade of D- or ECON 2350 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PHTH 2210 with a minimum grade of D- or POLS 2400 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- or IE 3412 with a minimum grade of D-

**MISM 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MISM 4405. IT Requirements Analysis and Modeling for Business. (4 Hours)**

Studies how to model and analyze stakeholder requirements in order to define a workable solution for a problem. Utilizes a small project development example to illustrate the process of requirements discovery, business problem scoping, functional requirements definition, and functional requirements modeling. Uses the Requirements Modeling Language as the modeling system. Also introduces iterative development of requirements and methods for communicating functional requirements.

**Prerequisite(s):** MISM 2420 with a minimum grade of D-

**MISM 4501. Strategic Information Products. (4 Hours)**

Examines significant improvements to business performance, which can be achieved through sharing information within the enterprise and with customers and suppliers. Realizing the full business benefits of shared information requires changing processes and organizational structures. This team- and project-based course offers students an opportunity to design and implement these strategies and to examine significant improvements to business performance.

**Prerequisite(s):** ECON 2350 with a minimum grade of D- or IE 3412 with a minimum grade of D- or IS 3500 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or MISM 2301 with a minimum grade of D- or MISM 2420 with a minimum grade of D- or PHTH 2210 with a minimum grade of D- or POLS 2400 with a minimum grade of D- or PSYC 2320 with a minimum grade of D-

**MISM 4983. Special Topics in Management Information Systems. (4 Hours)**

Offers special topics in Management Information Systems. May be repeated once.

**MISM 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MISM 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of faculty members of the department on a chosen topic. Course content depends on instructor. May be repeated up to four times for a maximum of 8 semester hours.

**MISM 6200. Introduction to Business Analytics. (3 Hours)**

Provides a comprehensive approach to understanding how business analytics enable companies to become more competitive. Offers students an opportunity to learn how to apply value chain analysis and other strategic perspectives to determine how business analytics can be integrated effectively into a firm's operations. Interactive activities such as simulations and case studies allow students to explore how insights from data can improve business decisions. Examines real-world examples of how companies have used business analytics perspectives and tools to enhance different types of business processes, such as inventory prediction, customer service quality, and resolution of ethical dilemmas.

**MISM 6201. Database Management for Business. (3 Hours)**

Introduces the methodological frameworks and tool sets for the design, development, and implementation of data management solutions for business. Offers students an opportunity to work hands-on, applying these methods and tools to solve actual business problems. Almost no aspect of business operates without a strong reliance on the flow of data. Even small enterprises track huge volumes of data, from sales transactions and supply chain activities to website traffic. Knowledge workers and managers at all levels within the organization require an understanding of data management, database design and operations, and associated decision-support and data analysis tools and systems to complete even day-to-day tasks.

**MISM 6202. Foundations of Data Analysis for Business. (3 Hours)**

Covers basic principles and techniques of descriptive and predictive analytics. What are the essential data analysis concepts underlying business analytics? Topics include descriptive statistics, data visualization, probability and modeling uncertainty, sampling, estimation and confidence intervals, hypothesis testing, analysis of variance, simple and multiple regression analysis, time-series analysis, and forecasting. Emphasizes an understanding of how these tools can support decision making and analytics initiatives in a business context with real-world examples and case studies. Uses various software packages for analyzing data sets and creating visualizations.

**MISM 6205. Data Wrangling for Business. (3 Hours)**

Covers data wrangling principles and techniques for business. Key topics include data extraction, profiling, cleansing, integration, aggregation, transformation, and automating data processes for business purposes. Applies principles and techniques using data transformation tools, programming languages, and data process automation tools. Emphasizes embedding appropriate communication mechanisms for collaboration for identifying, solving, and resolving challenges revealed in datasets and business processes. Offers students an opportunity to learn data wrangling techniques to identify, solve, and resolve real-world data challenges, creating business value in today's disparate computing and dynamic business environment.

**Prerequisite(s):** MISM 6202 with a minimum grade of C-

**MISM 6206. Modeling for Business. (3 Hours)**

Focuses on modern decision models in business analytics, with applications to business process design, revenue management, pricing, inventory control, business network planning, and other topics. Includes optimization, simulation, and selected data mining techniques. Emphasizes data-driven, real-world applications of mathematical decision tools and concepts.

**Prerequisite(s):** MGSC 6100 with a minimum grade of C- or MISM 6202 with a minimum grade of C-

**MISM 6210. Information Visuals and Dashboards for Business. (3 Hours)**

Introduces design principles for creating meaningful displays of information to support effective business decision making. Studies how to collect and process data; create interactive visualizations; and use them to demonstrate or provide insight into a problem, situation, or phenomenon. Introduces methods to critique visualizations along with ways to identify design principles that make good visualizations effective. Discusses the challenges of making data understandable across a wide range of audiences. Provides an overview of data visualization, key design principles and techniques for visualizing data, and the fundamentals of communication that are required for effective data presentation. Other topics may include ethical uses of information displays, storytelling, infographics, immersive visualizations, and information dashboard design. Offers students an opportunity to use one or more software tools.

**MISM 6211. Text Mining for Business. (3 Hours)**

Focuses on learning concepts, techniques, and tools to deal with understanding and analyzing massive text content. A large portion of today's businesses data is unstructured and in text format. Covers primarily text mining and includes parsing text to complex topics such as classification, clustering, and topic modeling. Emphasizes natural language processing techniques for processing data using segmentation, stemming and lemmatization, and document representation. Also focuses on extracting actionable knowledge from data using text classification and clustering, sentiment analysis, social media analysis, probabilistic topic models, and text visualization.

**Prerequisite(s):** MISM 6202 with a minimum grade of C-

**MISM 6212. Data Mining and Machine Learning for Business. (3 Hours)**

Examines data mining perspectives and methods in a business context. Introduces the theoretical foundations for major data mining methods and studies how to select and use the appropriate data mining method and the major advantages for each. Students use contemporary data mining software applications and practice basic programming skills. Focuses on solving real-world problems, which require data cleaning, data transformation, and data modeling.

**MISM 6213. Business Information Design, Quality, and Strategy. (3 Hours)**

Covers the leading data practices from early adopters, focusing on innovative information design, data quality, data sharing, and data integration perspectives and methods for managing data and business analytics. Explores how data analytics and management can be strategically implemented to transform a company. Discusses theories and contemporary industry practice, and real-world data and cases are used for discussion and projects. Offers students an opportunity to prepare for problem identification and solution perspectives of data-related projects, gearing up for MISM 6214.

**Prerequisite(s):** MISM 6201 with a minimum grade of C- or MISM 6205 with a minimum grade of C-

**MISM 6214. Business Analytics Capstone. (3 Hours)**

Offers students an opportunity to engage in a real-world project that engages all concepts and methods covered over the course of the business analytics program. Students apply the business analytics knowledge they have gained to collect, visualize, analyze, and manage data from a real company (or companies). Based on their results, students present a proposal for strategic actions to be taken by the company with a viable scope. The project is reviewed by peers, faculty, and external judges from industry.

**MISM 6250. Strategic AI for Business. (4 Hours)**

Explores how artificial intelligence integrates with business strategy and empowers businesses to enhance competitiveness. Focuses on leveraging machine learning techniques like unsupervised, supervised, and reinforcement learning for data-driven insights. Analyzes the intersection of managerial practices and AI capabilities through real-world case studies. Offers students an opportunity to gain practical insights into implementation and ethical considerations, recommend business solutions through the integration of AI capabilities, and navigate the dynamic landscape of AI-driven business transformations.

**MISM 6400. Introduction to Business Analytics. (2 Hours)**

Offers a comprehensive overview of how business analytics enable companies to become more competitive. Emphasizes value chain analysis and the strengths, weaknesses, opportunities, and threats, or SWOT, matrix to determine how businesses compete; introduces modern supervised and unsupervised machine learning models; and uses case studies to examine how different areas of the organization contribute to a business analytics capability. Discusses real-world examples of how businesses have enhanced prediction, customer service, and handled ethical considerations.

**MISM 6401. Database Management for Business. (2 Hours)**

Introduces methods and tool sets for designing, developing, and implementing data management solutions for business. Offers students an opportunity to work hands-on, applying these methods and tools to solve actual business problems. Data is essential in all business areas, with even small enterprises handling large volumes of data from sales transactions, supply chain activities, and web traffic. Knowledge workers to managers need a solid understanding of data management, database design, and analysis tools to support day-to-day operations and informed decision making.

**MISM 6402. Foundations of Data Analysis for Business. (2 Hours)**

Covers basic principles of descriptive and predictive analytics. Presents statistical models and techniques used for descriptive statistics; probability and modeling uncertainty; sampling, estimation, and confidence intervals; hypothesis testing; analysis of variance; simple and multiple regression analysis; time-series analysis; and forecasting. Emphasizes an understanding of how these tools can support decision-making and analytics initiatives in a business context with real-world examples and case studies. Uses various software packages for analyzing datasets and summarizing results.

**MISM 6405. Data Wrangling for Business. (2 Hours)**

Covers data wrangling principles and techniques for business. Key topics include data extraction, profiling, cleansing, integration, transformation, and automating data processes for business purposes. Applies principles and techniques using data transformation tools, programming languages, and data process automation tools. Offers students an opportunity to learn how to embed appropriate communication mechanisms for collaboration to identify and resolve real-world data challenges revealed in datasets and business processes, creating business value in today's disparate computing and dynamic business environment.

**Prerequisite(s):** MISM 6402 with a minimum grade of C-

**MISM 6406. Prescriptive Modeling for Business. (2 Hours)**

Focuses on modern prescriptive models in business analytics, with applications to process design, revenue management, pricing, inventory control, network planning, and other topics. Emphasizes techniques including linear and nonlinear optimization, simulation modeling, and decision analysis. Uses data-driven, real-world applications and hands-on project work to reinforce mathematical decision tools and concepts.

**Prerequisite(s):** MISM 6402 with a minimum grade of C-

**MISM 6410. Information Visuals and Dashboards for Business. (4 Hours)**

Introduces design principles for creating meaningful displays of information to support effective business decision making. Focuses on how the brain perceives preattentive attributes used by all visualizations; creating interactive visualizations; and using visualizations to demonstrate or provide insight into a problem, situation, or phenomenon. Introduces methods to critique visualizations along with ways to identify design principles that make good visualizations effective. Discusses the challenges of making data understandable across a wide range of audiences. Topics include several ways to use color in data visualization; preattentive attributes; lie factors; data density; the components of effectiveness in data visualization (accuracy, separability, discriminability, and popout); how to design dashboards; the differences between dashboards and infographics; maps; typography; deceptive visualizations; and data storytelling.

**MISM 6412. Data Mining and Machine Learning for Business. (4 Hours)**

Explores data mining perspectives and methods within a business context. Introduces the theoretical foundations of key data mining techniques and provides guidance on selecting and applying the appropriate methods for various business scenarios, highlighting the advantages of each approach. Offers students an opportunity to engage with contemporary data mining software applications and to develop basic programming skills. Covers both supervised and unsupervised learning methods, focusing on solving real-world business problems including data cleaning, data transformation, and data modeling.

**MISM 6413. Designing Information Products for Transforming Business. (4 Hours)**

Focuses on designing information products that drive strategic business transformation. Offers students an opportunity to engage with essential concepts, frameworks, technologies, and techniques to understand, analyze, design, and manage multisourced, context-rich data elements. Students critically explore real-world data from diverse technological origins, conduct comprehensive assessments of data quality, innovate in designing strategic information products aligned with organizational goals, and develop effective plans for managing these products. Explores transformational business strategies, knowledge, and skills to create information product solutions that propel business success.

**Prerequisite(s):** MISM 6401 with a minimum grade of C- or MISM 6405 with a minimum grade of C-

**MISM 6414. Business Analytics Capstone. (4 Hours)**

Invites students to engage in a comprehensive business analytics project or research within a real-world context. Students formulate an applied research question and identify a relevant business problem; explore data, technology, and related business processes and strategies; conduct research and analysis by applying theories and techniques to real-world data; and present their findings, solutions, and recommendations, emphasizing their implications and impacts. The capstone project may encompass both solution-oriented and research-focused elements, offering a holistic approach to business analytics.

**Management Science (MGSC)****MGSC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGSC 2301. Business Statistics. (4 Hours)**

Offers students an opportunity to obtain the necessary skills to collect, summarize, analyze, and interpret business-related data. Covers descriptive statistics, sampling and sampling distributions, statistical inference, relationships between variables, formulating and testing hypotheses, and regression analysis in the context of business. Use of the SPSS statistical programming package is an integral part of the course.

**Attribute(s):** NUpath Analyzing/Using Data

**MGSC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGSC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGSC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGSC 6100. Quantitative Foundations of Finance and Data Analytics. (3 Hours)**

Covers the quantitative skill sets that are crucial for success in data analytics and finance. Explores basic quantitative techniques of descriptive, predictive, and prescriptive analytics. Topics include descriptive statistics, data visualization, probability and modeling uncertainty, sampling, estimation and confidence intervals, hypothesis testing, and simple and multiple regression analysis. Uses various software packages for analyzing datasets and creating visualizations. Provides an in-depth overview of basic mathematics commonly used in finance. Topics include exponents and logarithms, systems of linear equations, compounding and geometric averages, evaluating large operators (e.g., summation expression), laws of natural logarithms, derivatives and first order conditions, and constrained maximizations. Uses Excel frequently but does not require prior experience with Excel.

**MGSC 6200. Information Analysis. (3 Hours)**

Provides students with basic information analysis skills and tools needed to manage effectively in today's information-intensive business climate. Exposes students to analytical problems from different areas of business and the quantitative concepts and techniques that can analyze them. Course objectives are to improve the information analysis skills of the students, to provide students with a working knowledge of important statistical tools, to help students become more critical evaluators of studies and reports involving statistical and quantitative methods, and to improve skills in communicating the results of analyses. Offers students the opportunity to learn how to evaluate, analyze, and interpret data, and present their findings and conclusions that will be most useful for managerial decision making through the use of business applications and analytical software.

**MGSC 6201. Information Systems and Technology. (3 Hours)**

Provides students with a fundamental understanding of the impact of technology on the organization and its financial systems. In particular, students are exposed to the new business models that technology enables and the control issues that these business models create. Discusses emerging technologies, digital business, supply chain, customer relationship management, and other technology subjects. Requires admission to MS/MBA program.

**MGSC 6204. Managing Information Resources. (1.5 Hours)**

Focuses on issues of the strategic uses of information technology for competitive advantage, support of business processes, information and control, digital business, integration of business with technology, organizational communication, and data management. Information has become a key resource in doing business. Managers must understand that high-quality information adds value to existing products and services, enhances the creation of new products, changes the efficiency and effectiveness of business processes, and affects relationships with customers, suppliers, and competitors.

**MGSC 6221. Introduction to Health Informatics and Health Information Systems. (3 Hours)**

Introduces the history and current status of information systems in healthcare: information architectures, administrative and clinical applications, evidence-based medicine, information retrieval, decision support systems, security and confidentiality, bioinformatics, information system cycles, the electronic health record, key health information systems and standards, and medical devices.

**MGSC 6281. Service Innovation and Management. (3 Hours)**

Examines innovation in services and the internal management of business processes. Uses a framework of service/process redesign. Emphasizes strategic initiatives and key organizational change elements critical for improving services to customers; increasing profitability; and building long-term customer loyalty across multiple industry sectors, including information technology, healthcare, financial services, and government. Introduces the various strategic aspects of process improvement in the delivery of services, including managing change and the resulting impact on the organization, supply-chain management in the service industry, process improvement, overcoming organizational resistance, customer involvement, empowerment, and the role of leadership in managing operations. Through guided project work, offers students an opportunity to apply these concepts to services and internal business processes at their own organizations.

**MGSC 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MGSC 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

## Managerial Economics (MECN)

### MECN 6200. Global Competition and Market Dominance. (3 Hours)

Trains managers to understand the competitive implications of global economic policies, the business effects of technological change, and the commercial imperatives of alternative political systems at a macro level. At a micro level, it creates a framework for industry analysis in a global setting that combines economic analysis, competitive analysis, and business decision-making skills.

### MECN 6205. Sustainability and the Economics of Markets. (3 Hours)

Examines the idea that building a sustainable business enterprise often involves correcting market failures. Examines the responsibilities of the business enterprise to society at large. Also explores the causes of and remedies for market failures, such as immigration, education, healthcare, climate change, and finance, and what these mean for governments, businesses, and individuals.

### MECN 6962. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Marketing (MKTG)

### MKTG 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### MKTG 2201. Introduction to Marketing. (4 Hours)

Provides an overview of the role of marketing in business and society. Considers the planning, implementation, and evaluation of marketing efforts in consumer and business-to-business companies, in service and goods companies, and in for-profit and nonprofit organizations. Also examines contemporary issues in marketing that can affect organizational success. A term project is used to enable students to apply their learning about the fundamentals of marketing.

### MKTG 2209. Introduction to Marketing. (4 Hours)

Does not count as credit for business majors. Counts as MKTG 2201 for business minors only.

### MKTG 2301. Marketing and Society. (4 Hours)

Examines the role of marketing and business in society's central contemporary problems as well as the way marketing can take a positive and influential role in the efforts to address these problems. Reviews some of our society's main problems and a critical view of marketing and business in today's world. Also examines changing marketing practices and roles for businesses as firms and institutions become more socially responsible and ethically aware. Finally, introduces and analyzes the role of prosocial marketing, how marketing can influence people's behavior for advancing a socially desirable change. Offers students an opportunity to better understand our society and enhance an ethical mind-set, while highlighting the ways marketers can contribute to societal well-being.

**Attribute(s):** NUpath Societies/Institutions

### MKTG 2601. Programming with Consumer Data. (4 Hours)

Introduces students to programming and data analysis through hands-on case studies using consumer data. Explores techniques to acquire, transform, visualize, and analyze consumer data using Python, with no prior experience required. Emphasizes practical applications and the interpretation of consumer data in the context of marketing decision making.

### MKTG 2602. Quantitative Analysis of Consumer Data. (4 Hours)

Introduces the fundamental techniques of quantitative data analysis and visualization in the marketing context. Emphasizes real-world consumer data and applications using R. Offers students an opportunity to learn a wide variety of foundational data-driven inference methods and progress to more advanced coursework delving into analyzing and understanding complex behavioral data. No previous experience in data analysis or programming required.

**MKTG 2720. Enabling Technologies for Consumer Engagement. (4 Hours)**

Introduces how organizations use the latest technologies for enhancing consumer engagement. Uses case studies and exercises to offer a broad overview of creative marketing applications across multiple industries and touchpoints. Examples may include augmented reality, virtual reality, mixed reality, internet of things, real-time interactivity, geolocation tools, wearables, dynamic content personalization, automation, social media, chatbots, voice assistants, and artificial intelligence.

**MKTG 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MKTG 3301. Marketing Management. (4 Hours)**

Focuses on the marketing process through the use of case studies simulating actual business settings and marketing challenges. Develops skill in marketing decision making, critical analysis, and communication. Topics include techniques for undertaking market analysis, marketing strategy (segmentation and positioning), and marketing implementation (4 Ps). A marketing plan project is used to enable students to apply their understanding about the marketing process.

**Prerequisite(s):** (MKTG 2201 with a minimum grade of D- or MKTG 2202 with a minimum grade of D- or MKTG 2209 with a minimum grade of D- )

**MKTG 3401. Marketing Research. (4 Hours)**

Offers students an opportunity to gain experience in the marketing research process, while working on a client-based project. Topics include problem definition, secondary research, exploratory research, experimental design, questionnaire design, sampling and recruitment, and data analysis and visualization. Exercises skills of project management, teamwork, and client relationship management. Seeks to prepare students for careers that utilize consumer insights to inform managerial decisions.

**Prerequisite(s):** (MKTG 2201 with a minimum grade of D- or MKTG 2202 with a minimum grade of D- or MKTG 2209 with a minimum grade of D- ); (MGSC 1201 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or MATH 2280 with a minimum grade of D- or ECON 2350 with a minimum grade of D- or MATH 3081 with a minimum grade of D- or POLS 2400 with a minimum grade of D- or IS 3500 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- or PHTH 2210 with a minimum grade of D- or IE 3412 with a minimum grade of D- )

**MKTG 3402. Gaining Insights from Consumer Data. (4 Hours)**

Examines how to capture, manage, analyze, and apply consumer data to gain a better understanding of consumer attitudes, preferences, and thought processes with the goal of helping organizations improve customer experience. Focuses on defining, designing, and solving marketing problems through data analysis and experimental design.

**Prerequisite(s):** ((CS 2000 with a minimum grade of D- or CS 2100 with a minimum grade of D- or CS 2500 with a minimum grade of D- or DS 2000 with a minimum grade of D- or DS 2500 with a minimum grade of D- or MKTG 2601 with a minimum grade of D- )); MKTG 2602 with a minimum grade of D-

**MKTG 3501. Marketing Analytics. (4 Hours)**

Examines a wide range of analytical approaches to support marketing decision making and performance measuring in organizations. Offers students an opportunity to learn how to implement such approaches in practice. Focuses on identifying and acquiring relevant data to address different marketing challenges, conducting relevant quantitative analyses, and communicating obtained insights across the organization to make better marketing decisions.

**Prerequisite(s):** MKTG 3401 (may be taken concurrently) with a minimum grade of D- or MKTG 3402 with a minimum grade of D-

**MKTG 3720. Brand Management. (4 Hours)**

Introduces students to the multifaceted responsibilities of a brand manager, including understanding market trends and the competitive landscape; developing the brand story; conducting and analyzing consumer research to identify brand opportunities; creating and maintaining a brand budget; establishing and implementing cross-platform brand communication strategy; measuring brand performance; and executing marketing and advertising campaigns. Brand managers in technology, consumer packaged goods (CPG), and service organizations shape the trajectories of global brands and products.

**MKTG 3945. Experiential B2B Marketing and Innovation: Industry Challenge in the Context of a Global Enterprise. (4 Hours)**

Emphasizes business-to-business (B2B) marketing and develops students' ability to propose solutions to real-world challenges faced by a B2B corporation. Uses the help of an industry partner to present B2B concepts against the backdrop of innovation and partnership building. Offers students the opportunity to gain insight into a B2B company's products, history, current marketing strategies, and past projects. Examines and contrasts B2B and B2C marketing and innovation, covers B2B strategy design and partnerships, and provides guidance on managing creative processes. Introduces students to a series of new challenges presented by senior management, prompting students to develop practical solutions and effectively present their proposals to management. Focuses on the process of developing innovative solutions for real-world challenges, including creating storyboards, designing content, and practicing professional pitches.

**Prerequisite(s):** MKTG 2201 with a minimum grade of D- or MKTG 2209 with a minimum grade of D-

**Attribute(s):** NUpath Integration Experience

**MKTG 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MKTG 4120. Undergraduate Research Practicum in Marketing. (4 Hours)**

Offers students an advanced-level experiential learning opportunity working directly with a faculty mentor on an academic marketing research project. Depending on the mutual interests of students and faculty, research may be behavioral/experimental or quantitative/analytical in nature. Engages students in multiple aspects of a research project: literature review; theory development; hypothesis generation; research design; data analysis and visualization; and developing insights for managers, researchers, and policy. Students meet weekly with the course instructors for skill-building sessions and lab meetings.

**MKTG 4220. Marketing in Asia. (4 Hours)**

Studies the opportunities and challenges associated with the increasing globalization of Indian and Asian markets. During this Dialogue of Civilizations, students study key environmental forces shaping consumer needs and preferences, the impact of foreign political and economic factors on entering companies, the influence of international competition, market segmentation, and strategy decisions specific to Asian marketing. Analyzes the impact of cultural, social, political, and economic factors on marketing strategies. Offers students an opportunity to learn how to determine when to use different market entry and penetration strategies and how to examine the different skills and systems required to implement marketing strategies in India and broader Asia.

**MKTG 4420. Sales Management. (4 Hours)**

Focuses on the entire sales effort. Offers students the opportunity to apply a proven selling process and present compelling solutions to customers. Topics include how to translate product features into buyer benefits, how to handle customer objections, and how to close sales and deals. Covers team selling and relationship marketing. Intended for students interested in a sales career as well as future product managers who must rely on the sales force to introduce new products and promotions.

**Prerequisite(s):** MKTG 2201 with a minimum grade of D- or MKTG 2209 with a minimum grade of D-

**MKTG 4502. Managing Customer Engagement in a Service World. (4 Hours)**

Examines why people are essential to success, why expectations are important to consumers, and how physical and virtual environments influence delivery of value to customers. Focuses on active skill building and tool development in a practice-oriented approach that is quickly and directly applicable to students' future careers. The primary theme of the course is that both service organizations and product organizations require a distinctive approach to marketing strategy in a world where all organizations increasingly depend on service excellence and customer engagement for competitive advantage.

**Prerequisite(s):** MKTG 2201 with a minimum grade of D- or MKTG 2202 with a minimum grade of D- or MKTG 2209 with a minimum grade of D-

**MKTG 4504. Advertising and Brand Promotion. (4 Hours)**

Focuses on developing a creative advertising strategy and brand plan that aligns with a company's overall marketing objectives. Topics include the business of brands, marketing strategy, ethical and legal considerations in advertising, advertising strategy development, media planning and buying, creative development and testing, identifying and measuring success on key performance indicators, historical foundations of advertising, and what's next in the industry. Students apply course concepts to develop a creative advertising strategy to address campaign objectives.

**Prerequisite(s):** MKTG 2201 with a minimum grade of D- or MKTG 2202 with a minimum grade of D- or MKTG 2209 with a minimum grade of D-

**MKTG 4506. Consumer Behavior. (4 Hours)**

Incorporates the latest research in marketing, psychology, and other behavioral sciences to help students develop evidence-based strategies for predicting and influencing consumer behavior. Consumers are at the center of the business value creation process; therefore, an understanding of consumer thoughts, feelings, and actions is critical for business success. Offers students an opportunity to learn how to successfully target the right audience by conducting and interpreting market research; shape thoughts by getting consumers' attention and making a lasting impression; influence attitudes by applying principles of persuasion and social influence; and impact consumer decisions by harnessing motivations and drivers of behavior.

**Prerequisite(s):** MKTG 2201 with a minimum grade of D- or MKTG 2202 with a minimum grade of D- or MKTG 2209 with a minimum grade of D-

**MKTG 4508. Digital Marketing. (4 Hours)**

Examines the impact of technology on the marketing of goods and services. Focuses on the Internet and the World Wide Web. Investigates recent trends in e-business and identifies marketing strategies that work in this new environment. Introduces students to frameworks that help explain current issues in electronic marketing. Although the focus is on Internet marketing strategy, phenomena such as television home shopping and database marketing are also explored. Readings, cases, discussions, lectures, guest speakers, student reports, and exercises on the World Wide Web are all utilized.

**Prerequisite(s):** MKTG 2201 with a minimum grade of D- or MKTG 2202 with a minimum grade of D- or MKTG 2209 with a minimum grade of D-

**MKTG 4510. New Product Development. (4 Hours)**

Provides an overview of the new-product-development process, with an emphasis on customer involvement in this process. Detailed insights are provided on such topics as new-product strategy, idea generation, idea selection and evaluation, concept development and testing, product development and testing, and market testing and product launch.

**Prerequisite(s):** MKTG 2602 with a minimum grade of D- or MKTG 3401 (may be taken concurrently) with a minimum grade of D-

**MKTG 4512. International Marketing. (4 Hours)**

Introduces those aspects of marketing that are unique to international business within the framework of traditional functional areas of marketing. Focuses on the environment and the modifications of marketing concepts and practices necessitated by environmental differences. Topics include cultural dynamics in international markets, political and legal environmental constraints, educational and economic constraints, international marketing research, international marketing institutions, and marketing practices abroad.

**Prerequisite(s):** MKTG 2201 with a minimum grade of D- or MKTG 2202 with a minimum grade of D- or MKTG 2209 with a minimum grade of D-

**MKTG 4604. Creating Business Value with Data and AI Technologies. (4 Hours)**

Designed to prepare students for careers that demand an understanding of the intersection between the growing data-driven and technology-enabled possibilities and various ways in which they can be creatively leveraged for designing better digital products and markets. Rapidly emerging new digital ecosystems, platforms, products, and services have been fundamentally transforming business practices and market landscapes in almost every industry. Using real-life case studies and projects, students examine and apply fundamental economic principles and conceptual business frameworks that are essential for understanding how emerging data opportunities and new computing technologies can be used for value creation. Considers various approaches for establishing fair and appropriate rules, regulations, and policies to mitigate potential biases, ethical challenges, and discrimination arising due to the digital transformation.

**MKTG 4606. Digital, Analytics, Technology, and Automation Research Practicum. (4 Hours)**

Offers an advanced-level experiential learning opportunity for students who wish to gain exposure to solving problems facing businesses and other organizations using data analytics and digital technology applications. The practicum offers students an opportunity to learn through active participation in client-centric challenges in a DATA context. Faculty and organizations present a variety of such challenges, and students are guided through solving these challenges. Discusses how new technologies affect human behavior, examines how digital convergence impacts society and organizations, and studies how to apply state-of-the-art methods in machine learning to create value for businesses and organizations. Students practice communicating and enabling change within organizations. Focuses on building students' technical and managerial skills to develop capacities to situate a business problem in a wider research context.

**MKTG 4720. Understanding the Platform Economy. (4 Hours)**

Examines the key drivers and building blocks of digital business transformations underlying the best marketing practices of the platform economy and discusses how companies can successfully take advantage of emerging multisided platforms and market-driven network externalities. Offers students an opportunity to learn how platforms change the way firms and consumers transact; to identify customer groups whose affiliation with the platform is most valuable; to understand the dynamics and limitations of platform-based network effects; to design competitive platform-based marketing strategies; and to develop plans for turning products and services into sustainable platforms. Explores consumer-based perspectives to highlight potential biases and discrimination arising in the platform economy. Considers various approaches for establishing fair and appropriate regulations and policies to mitigate such issues.

**MKTG 4983. Special Topics in Marketing. (4 Hours)**

Offers special topics in marketing. May be repeated once.

**MKTG 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MKTG 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of faculty members of the department on a chosen topic. Course content depends on instructor. May be repeated up to four times for a maximum of 8 semester hours.

**MKTG 6120. Graduate Research Practicum in Marketing. (3 Hours)**

Offers an advanced-level experiential learning opportunity for students considering an academic career in marketing. Research may be behavioral/experimental or quantitative/analytical in nature. Engages students in multiple aspects of a research project: literature review; theory development; hypothesis generation; research design; data analysis and visualization; and developing insights for managers, researchers, and policy. Students participate in formal research training; attend weekly meetings with the faculty leads for the course; present their research; and submit a research paper at the end of the semester.

**MKTG 6200. Creating and Sustaining Customer Markets. (3 Hours)**

Focuses on marketing analysis and planning. Emphasizes analysis of customer needs and company and competitor capabilities. This analysis forms the basis of a sound marketing strategy that provides value to customers in a way superior to competitors. Discusses how to deliver this strategy through the development of an integrated marketing program covering product offerings, pricing, promotion, and distribution. Includes professional accounting students.

**MKTG 6210. Marketing Research. (3 Hours)**

Provides an overview of the major qualitative and quantitative marketing research methodologies available to marketing managers. Explores customer relationship management (CRM) and multivariate statistical techniques including conjoint analysis, customer satisfaction, and service quality measurement.

**Prerequisite(s):** (MKTG 6200 with a minimum grade of C- or MKTG 6208 with a minimum grade of C- or MKTG 6318 with a minimum grade of C-); (MGSC 6200 with a minimum grade of C- or MGSC 6207 with a minimum grade of C-)

**MKTG 6212. International Marketing. (3 Hours)**

Develops understanding of the opportunities and challenges facing the international marketing executive, the decision-making process in marketing goods abroad, and the environmental forces—economic, cultural, and political—affecting the marketing process in the international marketplace.

**Prerequisite(s):** MKTG 6200 with a minimum grade of C- or MKTG 6208 with a minimum grade of C- or MKTG 6318 with a minimum grade of C-

**MKTG 6214. New Product Development. (3 Hours)**

Focuses on the challenges and decisions new-product managers face as they take ideas through the new-product-development process. Companies need to create, develop, and market new products and services continually to compete effectively in a rapidly changing environment. Provides an overview of the new-product-development process, with an emphasis on customer involvement in this process. Provides detailed insights on such topics as new-product strategy, idea generation, idea selection and evaluation, concept development and testing, product development and testing, and market testing.

**Prerequisite(s):** MKTG 6200 with a minimum grade of C- or MKTG 6208 with a minimum grade of C- or MKTG 6318 with a minimum grade of C-

**MKTG 6216. Market Focused Strategy. (3 Hours)**

Offers an advanced course in defining and managing an organization's product-market strategy. Intended for marketing specialists and nonspecialists interested in incorporating a market focus from a general management or consulting perspective. Emphasizes using market information to choose and manage the company's relationships with customers and competitors in a complex, changing environment, as well as the practical concerns of implementing and evaluating marketing strategy.

**Prerequisite(s):** MKTG 6200 with a minimum grade of C- or MKTG 6208 with a minimum grade of C- or MKTG 6318 with a minimum grade of C-

**MKTG 6218. Managing Customer Engagement in a Service World. (3 Hours)**

Examines how both service organizations and product organizations require a distinctive approach to marketing strategy in a world where all organizations increasingly depend on service excellence and customer engagement for competitive advantage. The world economy is dominated by services; in the United States, a large percentage of the labor force and the GDP is accounted for by services. Covers why people are essential to success, why expectations are important to consumers, and how physical and virtual environments influence delivery of value to customers. This practice-oriented course focuses on active skill building and tool development that is quickly and directly applicable to students' future careers.

**Prerequisite(s):** MKTG 6200 with a minimum grade of C- or MKTG 6208 with a minimum grade of C- or MKTG 6318 with a minimum grade of C-

**MKTG 6222. Digital Marketing. (3 Hours)**

Explores the latest trends in technology and new media, their effect on marketing goods and services, and how to deliver value to the customer using the latest technological innovations. Examines the latest trends in digital marketing, such as mobile marketing, and how the mobile platform can be used for branding purposes and to enhance customer relationships. Explores topics such as branding and advertising via mobile phones, online social networks and communities, technology adoption in global emerging markets, and how the Internet empowers customers and enables firms to engage in customer advocacy. Also examines how marketing research is conducted for technological innovations and ethical concerns that arise with technology usage, such as privacy and security issues, identity theft, and the role of trust in digital marketing.

**Prerequisite(s):** MKTG 6200 with a minimum grade of C- or MKTG 6208 with a minimum grade of C- or MKTG 6318 with a minimum grade of C-

**MKTG 6223. Brand and Advertising Management. (3 Hours)**

Offers students an opportunity to obtain an in-depth understanding of the brand-building process amid radical changes in today's marketing communications platforms. Exposes students to concepts, frameworks, and theories critical to developing branding and advertising strategy in the twenty-first century, including brand positioning, target audiences definition, creative advertising, integrated marketing communications, the influence of social media, and assessing marketing and media effectiveness.

**Prerequisite(s):** MKTG 6200 with a minimum grade of C- or MKTG 6208 with a minimum grade of C- or MKTG 6318 with a minimum grade of C-

**MKTG 6226. Consumer Behavior. (3 Hours)**

Focuses on the consumer as the key element of marketing strategy and application. Explores demographic, lifestyle, social, and cultural trends and their impact on consumer attitudes, motivations, and behavior. Other topics include group dynamics, family, learning, personality, and emotions and their impact on the business world. Offers an in-depth look at the consumer decision process as a model to guide the planning and evaluation of marketing strategies.

**Prerequisite(s):** MKTG 6200 with a minimum grade of C- or MKTG 6208 with a minimum grade of C- or MKTG 6318 with a minimum grade of C-

**MKTG 6230. Driving Marketing Performance: Measure, Analyze, Profit. (3 Hours)**

Introduces how to measure, analyze, and evaluate the profit impact of marketing actions (MAP) by bringing together marketing, strategy, and finance. Your organization is going to spend millions on a new marketing or strategic initiative, but how will you know if it is working? Marketing performance measurement and feedback systems enable managers to take smarter risks by assessing experimental projects and forecasting the profit potential of bigger, bolder initiatives. Offers students an opportunity to explore systems that summarize marketing productivity and suggest steps for performance improvement in marketing strategy and tactics.

**Prerequisite(s):** MKTG 6200 with a minimum grade of C- or MKTG 6208 with a minimum grade of C- or MKTG 6210 with a minimum grade of C- or MKTG 6318 with a minimum grade of C-

**MKTG 6232. Engaging Customers and Markets. (3 Hours)**

Introduces informationcentric methods that help to choose which customer markets are worth pursuing; that identify what benefits would be most attractive to offer these customers; and that develop, communicate, and deliver products and services that provide value to both customers and organizations. In the current customercentric marketplace, every member within an organization is responsible for understanding and engaging customers, regardless of their specific functional role. Properly collecting and utilizing data from inside and outside the organization is necessary to support this process. Using real-world cases, scenarios, and data, offers students an opportunity to learn how customer relationships can be created and sustained.

**MKTG 6234. Marketing Analytics. (3 Hours)**

Offers students an opportunity to understand the importance of using an analytical approach to support marketing decision making in organizations and approaches to implementation practice. Focuses on identifying and acquiring the right data for addressing different marketing challenges; building skills necessary for conducting relevant quantitative analyses; and using insights to make better marketing decisions. Topics may include product innovation, market identification and segmentation, customer valuation, media attribution models, and assessment of digital and social media. Students are expected to apply statistical concepts and have the opportunity to use SPSS, Python, and/or R for analyzing marketing data sets.

**MKTG 6283. Marketing and Selling Innovation. (3 Hours)**

Reviews the product portfolio concept, examining the need for balanced portfolios and focusing on issues related to product proliferation and simplification. Discusses market-based pricing strategies, sales efforts, distribution, and communication in the context of enhancing the firm's product position in the marketplace. Focuses on developing and executing sales. Explores business-to-business and business-to-customer strategies.

**MKTG 6285. Creating Customer Value through Artificial Intelligence. (3 Hours)**

Investigates how companies can create customer value through artificial intelligence. Studies companies from startups to large multinationals across a variety of industries. Analyzes the AI strategies implemented or attempted by these companies to understand drivers of success and identify future opportunities. Uses lectures, case discussions, team and individual exercises, and a project on creating a value-driven AI strategy to offer students an opportunity to begin to develop intuition behind modern AI technologies. Does not require coding or algorithm development.

**MKTG 6287. Succeeding in the Platform Economy. (3 Hours)**

Examines the key drivers and building blocks of digital business transformations underlying the best marketing practices of the platform economy. Discusses how companies can successfully take advantage of emerging multisided platforms and market-driven network externalities. Offers students an opportunity to learn how platforms change the way firms and consumers transact; identify customer groups whose affiliation with the platform is most valuable; understand the dynamics and limitations of platform-based network effects; design competitive platform-based marketing strategies; and develop plans for turning products and services into sustainable customer-centric platforms. Explores consumer-based perspectives to highlight potential biases and discrimination arising in the platform economy, and considers various approaches for establishing fair and appropriate regulations and policies to mitigate such issues.

**MKTG 6294. Customer-Centric Research Methods for Marketing. (3 Hours)**

Focuses on the marketing research process and the analysis of data using software applications. Marketing research helps businesses know their customers and aids in business decision making. Covers topics such as problem definition, research design, sampling, attitude measurement, survey design, data collection, and data analysis. Students apply course topics to their organizations and analyze real company customer satisfaction data to provide managerial insights for a decision maker. Cases highlight the research process, mobile qualitative methods, and practical decision-making skills. SPSS, Qualtrics, and IBM Watson Analytics may be used to develop and analyze the project components.

**MKTG 6295. Customer Performance Modeling. (3 Hours)**

Addresses the question of how you know if and when your company's marketing initiatives are impacting customers and creating profit. Covers customer performance measurement, modeling, and feedback systems managers can use to take smarter risks by assessing the marketing initiatives and forecasting profit potentials. Offers students an opportunity to learn how to develop marketing dashboards, through which marketing productivity and profits can be assessed and evaluated. Also covers strategy and tactics that can be developed and communicated, with accountability in mind.

**MKTG 6318. Customer Value and the Enterprise. (2 Hours)**

Examines the role of marketing as an organizational function and a set of processes to manage offerings that provide superior value to customers. Focuses on developing student skill in analyzing the customer and business environment and using that analysis to build an effective marketing strategy. Emphasizes methods for the identification, acquisition, and retention of customers in a way that provides mutual value to the customer and the organization.

**MKTG 6320. Advanced Marketing Management. (3 Hours)**

Examines the specific elements of marketing management, including market research, metrics, positioning, planning, and the marketing mix. Focuses on developing student skills in putting together a marketing plan based on a thorough understanding of the market. Emphasizes predicting consumer behavior, developing points of difference and parity, calibrating the different elements of the market offering, and going to market with clear performance indicators.

**Prerequisite(s):** MKTG 6318 with a minimum grade of C-

**MKTG 6430. Driving Marketing Performance: Measure, Analyze, Profit. (2 Hours)**

Introduces how to measure, analyze, and evaluate the profit impact of marketing actions (MAP) by bringing together marketing, strategy, and finance. Your organization is going to spend millions on a new marketing or strategic initiative, but how will you know if it is working? Marketing performance measurement and feedback systems enable managers to take smarter risks by assessing experimental projects and forecasting the profit potential of bigger, bolder initiatives. Offers students an opportunity to explore systems that summarize marketing productivity and suggest steps for performance improvement in marketing strategy and tactics.

**MKTG 6434. Marketing Analytics. (4 Hours)**

Offers students an opportunity to understand the importance of using an analytical approach to support marketing decision making in organizations and approaches to implementation practice. Focuses on identifying and acquiring the right data for addressing different marketing challenges; building skills necessary for conducting relevant quantitative analyses; and using insights to make better marketing decisions. Topics may include product innovation, market identification and segmentation, customer valuation, media attribution models, and assessment of digital and social media. Students are expected to apply statistical concepts and have the opportunity to use SPSS, Python, and/or R for analyzing marketing data sets.

**MKTG 6606. Digital, Analytics, Technology, and Automation Advanced Research Practicum. (3 Hours)**

Offers students an advanced-level experiential learning opportunity to actively participate to solve client-centric challenges facing businesses and other organizations using data analytics and digital technology applications. Faculty and organizations present a variety of such challenges, and students are guided through solving these challenges. Discusses how new technologies affect human behavior, examines how digital convergence impacts society, and studies how to apply state-of-the-art methods in machine learning to create value for businesses. Students practice communicating and enabling change within organizations. Focuses on building students' technical and managerial skills to develop capacities to situate a problem in a wider research context and to develop a communication approach to deliver technical information to different audiences.

**MKTG 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MKTG 7001. Interdisciplinary Research in Marketing Science. (4 Hours)**

Exposees students to cutting-edge research in quantitative marketing to help them define and advance their interdisciplinary research interests. Explains the process of generating feasible, interesting, and managerially relevant research ideas. Focuses on research opportunities arising from applications of new algorithms and technologies to generate consumer insights and automate product recommendations; improve privacy-preserving personalization; understand the increasingly complex advertising landscape and smart devices ecosystem; capture and analyze large unstructured data such as biomarkers, geolocation, networks, video, voice, and text in order to improve consumer experiences. Designed for graduate students with a background in computational social science, computer science, data analytics, digital humanities, economics, engineering, and network science who are interested in consumer-focused interdisciplinary empirical research projects. Expects students to produce a major paper suitable for publication.

**MKTG 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

**Marketing - CPS (MKT)****MKT 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MKT 2100. Principles of Marketing. (3 Hours)**

Introduces the fundamentals of marketing management, including marketing strategy, consumer decision making, market segmentation and targeting, product, promotion, distribution, and pricing strategies. Emphasizes the importance of ethical behavior in marketing in both profit and nonprofit organizations operating at a domestic or a global level.

**Prerequisite(s):** MGT 1100 with a minimum grade of D- or CMN 1100 with a minimum grade of D- or CMN 1103 with a minimum grade of D- or CMN 2210 with a minimum grade of D- or HMG 1100 with a minimum grade of D-

**MKT 2220. Consumer Behavior. (3 Hours)**

Examines the major theoretical approaches to consumer behavior. Examines how the concepts of affect and cognition, behavior, and learning can be used to design and execute an effective marketing strategy in an environment that is more consumer empowered. Understanding the decision-making process, attitude, and behavior of buyers, as well as the impact of the environment, is essential to developing marketing plans in which sophisticated customer relationship management approaches are dependent upon knowing the customer needs and motives. Offers students an opportunity to gain a better understanding of their own buying behavior.

**Prerequisite(s):** MKT 2100 with a minimum grade of D-

**MKT 2700. Product Design and Development. (3 Hours)**

Introduces the methods used by companies to design and develop new products. New product development is a process that requires cross-functional collaboration and inter-disciplinary skills, which requires students to be exposed to concepts and analytical methods from a variety of disciplines, including marketing, project management, supply chain management, design and manufacturing, and cost accounting. Students are provided an opportunity to work individually and in teams to solve real business challenges, designing and developing products, as well as formulating strategies on how to improve their market success.

**MKT 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MKT 3010. Digital Marketing. (3 Hours)**

Explores the transition of traditional marketing to human-centric marketing in the digital age. Addresses evolving customer needs requiring business to utilize ever-changing technology in digital marketing. Discusses human-centric concepts including power shifts, human connectivity, changes in human lives, and user experience for customers. Offers students an opportunity to develop greater understanding of customer paths, new marketing metrics and practices, omnichannel marketing, customer engagement, and the use of social media.

**Prerequisite(s):** MKT 2100 with a minimum grade of D-

**MKT 3100. Marketing Analytics. (3 Hours)**

Examines the basic principles, tools, and models associated with marketing analytics. Emphasizes the development of skills to acquire and monitor marketing data, select the correct analytical methods to solve marketing problems, generate marketing insights, and apply the results of analyses to positively impact an organization's approach to market challenges.

**Prerequisite(s):** MKT 3010 with a minimum grade of D- ; MTH 2300 with a minimum grade of D-

**MKT 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MKT 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**MKT 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MKT 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Materials Engineering (MATL)****MATL 6250. Soft Matter. (4 Hours)**

Introduces the relatively young field of soft matter, which encompasses the physical description of various states of soft materials including liquids, colloids, polymers, foams, gels, granular materials, and a number of biological materials. Soft matter (also known as "soft condensed matter" or "complex fluids") is less ordered than metals and oxides (hard condensed matter) and is more subject to thermal fluctuations and applied forces. Focuses on critical thinking, problem diagnosis, estimation, statistical analysis, and data-based decision making. Includes many in-class demonstrations from colloidal assembly to emulsion stability to cellular apoptosis. Highlights applications such as industrial processing, life sciences, and environmental remediation. Requires graduate study in related field or permission of instructor.

**MATL 6270. Principles, Devices, and Materials for Energy Storage and Energy Harvesting. (4 Hours)**

Introduces students to materials, devices, and mechanisms for clean and sustainable energy while providing a broad overview of energy storage and energy harvesting. Offers examples related to materials and devices used in energy storage and harvesting and delves into the principles that underlie the performance of advanced electrochemical storage and harvesting systems, for example solar energy and mechanical energy. Also covers efficient energy usage, such as energy-efficient lighting and building. Beyond course content, assignments provide students with opportunities to practice concise writing and peer review of abstracts, deliver scientific presentations, and explore optimum ways to present technical information. Students should have some prior knowledge of materials science, electrochemistry, and/or semiconductor physics.

**MATL 6285. Structure, Properties, and Processing of Polymeric Materials. (4 Hours)**

Provides an introduction to the organic chemistry of polymers, the effects of chemical composition on structure, melting point, and degradation, and the thermodynamics of polymers. Other topics include the mechanical properties of polymers, analysis and testing, the effects of processing on structures and properties, and the processing of industrial polymers, with applications.

**MATL 6290. Fundamentals of Nanostructured Materials. (4 Hours)**

Covers fundamentals of 1D and 2D nanomaterials such as carbon nanotubes, graphene, nanowires, 2D atomic crystals (transition metal dichalcogenides), nanostructured graphites and their novel physical properties, and related nanotechnology. Draws from various textbooks and from seminal scientific journal articles that paved the new era of nanomaterials and nanotechnology in the past couple of decades. Includes lab demonstrations and assignments for some nanomaterials synthesis and characterization. An introduction to materials science and engineering, solid-state physics, chemistry of materials, or any related materials engineering background is strongly recommended.

**MATL 6300. Computational Material Science. (4 Hours)**

Covers the principles and practice of modern computer simulation techniques used to understand solids, liquids, and gases. Reviews the statistical foundation of thermodynamics followed by in-depth discussion of Monte Carlo and molecular dynamics techniques, as well as their links to mesoscale and continuum computational techniques. Discusses intermolecular potentials; extended ensembles; and mathematical algorithms used in molecular simulations, parallel algorithms, and visualization. Requires knowledge of materials science.

**Prerequisite(s):** ME 6200 with a minimum grade of C-

**MATL 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MATL 7350. Mechanical Behavior and Strengthening Mechanisms. (4 Hours)**

Covers dislocation theory and includes such topics as crystalline defects, elastic properties of dislocation, movement of dislocations, multiplication, intersection, annihilation, dislocations in crystalline materials, and dislocation arrays and crystal boundaries. Examines application of dislocation theory to microplasticity, dynamic recovery and recrystallization, strengthening mechanisms, and high-temperature deformation. Requires knowledge of materials science.

**MATL 7355. Thermodynamics of Materials. (4 Hours)**

Covers fundamentals of materials thermodynamics that encompass the first, second, and third laws, entropy, enthalpy, and free energy. Emphasis is on phase stability and equilibria, phase diagram computation with applications to phases in metals, alloys, and ionic compounds. Requires knowledge of thermodynamics course and materials science course.

**MATL 7360. Kinetics of Phase Transformations. (4 Hours)**

Focuses on the different types of phase transformations that occur in materials in relation to theory and practice. Topics include the diffusion equations, mechanisms of diffusion in crystalline solids, random walk theory, ionic conduction, high-diffusivity paths, diffusional and nondiffusional phase transformations, and microstructural evolution in material processing.

**Prerequisite(s):** MATL 7355 with a minimum grade of C-

**MATL 7365. Properties and Processing of Electronic Materials. (4 Hours)**

Focuses on electronic principles and the processing techniques underlying the processing/structure/property relationships of materials. Covers metals and alloys, semiconductors, and insulators. Topics include electronic structures, band theory; thermal, electrical, and magnetic properties; and processing methods including film deposition.

**MATL 7945. Master's Project. (4 Hours)**

Offers theoretical or experimental work under individual faculty supervision.

**MATL 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MATL 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**MATL 7990. Thesis. (4 Hours)**

Offers analytical and/or experimental work conducted under the direction of the faculty in fulfillment of the requirements for the degree.

**Prerequisite(s):** MATL 7945 with a minimum grade of C-

**MATL 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers continuing master's thesis supervision under individual faculty supervision.

## Mathematics (MATH)

**MATH 1000. Mathematics at Northeastern. (1 Hour)**

Designed for freshman math majors to introduce them to one another, their major, their college, and the University. Students are introduced to our advising system, register for next semester's courses, and learn more about co-op. Also helps students develop the academic and interpersonal skills necessary to succeed as a university student.

**MATH 1120. Precalculus. (4 Hours)**

Focuses on linear, polynomial, exponential, logarithmic, and trigonometric functions. Emphasis is placed on understanding, manipulating, and graphing these basic functions, their inverses and compositions, and using them to model real-world situations (that is, exponential growth and decay, periodic phenomena). Equations involving these functions are solved using appropriate techniques. Special consideration is given to choosing reasonable functions to fit numerical data.

**MATH 1213. Interactive Mathematics. (4 Hours)**

Develops problem-solving skills while simultaneously teaching mathematics concepts. Each unit centers on a particular applied problem, which serves to introduce the relevant mathematical topics. These may include but are not limited to polling theory, rate of change, the concepts behind derivatives, probability, binomial distributions, and statistics. The course is not taught in the traditional lecture format and is particularly suited to students who work well in collaborative groups and who enjoy writing about the concepts they are learning. Assessment is based on portfolios, written projects, solutions to "problems of the week," and exams.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**MATH 1215. Mathematical Thinking. (4 Hours)**

Focuses on the development of mathematical thinking and its use in a variety of contexts to translate real-world problems into mathematical form and, through analysis, to obtain new information and reach conclusions about the original problems. Mathematical topics include symbolic logic, truth tables, valid arguments, counting principles, and topics in probability theory such as Bayes' theorem, the binomial distribution, and expected value.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**MATH 1216. Recitation for MATH 1215. (0 Hours)**

Provides small-group discussion format to cover material in MATH 1215.

**MATH 1220. Mathematics of Art. (4 Hours)**

Presents mathematical connections and foundations for art. Topics vary and may include aspects of linear perspective and vanishing points, symmetry and patterns, tilings and polygons, Platonic solids and polyhedra, golden ratio, non-Euclidean geometry, hyperbolic geometry, fractals, and other topics. Includes connections and examples in different cultures.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Formal/Quant Reasoning

**MATH 1231. Calculus for Business and Economics. (4 Hours)**

Provides an overview of differential calculus including derivatives of power, exponential, logarithmic, logistic functions, and functions built from these. Derivatives are used to model rates of change, to estimate change, to optimize functions, and in marginal analysis. The integral calculus is applied to accumulation functions and future value. Emphasis is on realistic business and economics problems, the development of mathematical models from raw business data, and the translation of mathematical results into verbal expression appropriate for the business setting. Also features a semester-long marketing project in which students gather raw data, model it, and use calculus to make business decisions; each student is responsible for a ten-minute presentation. (Graphing calculator required, see instructor for make and model.)

**Attribute(s):** NUpath Formal/Quant Reasoning

**MATH 1241. Calculus 1. (4 Hours)**

Serves as both the first half of a two-semester calculus sequence and as a self-contained one-semester course in differential and integral calculus. Introduces basic concepts and techniques of differentiation and integration and applies them to polynomial, exponential, log, and trigonometric functions. Emphasizes the derivative as rate of change and integral as accumulator. Applications include optimization, growth and decay, area, volume, and motion.

**Attribute(s):** NUpath Formal/Quant Reasoning

**MATH 1242. Calculus 2. (4 Hours)**

Continues MATH 1241. Introduces additional techniques of integration and numerical approximations of integrals and the use of integral tables; further applications of integrals. Also introduces differential equations and slope fields, and elementary solutions. Introduces functions of several variables, partial derivatives, and multiple integrals.

**Prerequisite(s):** MATH 1231 with a minimum grade of D- or MATH 1241 with a minimum grade of D- or MATH 1341 with a minimum grade of D-

**Attribute(s):** NUpath Formal/Quant Reasoning

**MATH 1245. Calculus with Applications. (4 Hours)**

Covers differential and integral calculus of one variable and an introduction to differential equations. Includes applications that show how calculus is used to solve problems in science. Also includes a group project related to a real-world problem in students' areas of study. The project involves a differential equation and compares the solution with experiment. Previous examples of projects include modeling of coral reefs, analysis of an epidemic using the data of the World Health Organization, analysis of a two-component kinetic model of drug concentration, and gate analysis of hip to knee experiment and comparison with the solution of the pendulum equation. Prior exposure to high-school-level calculus is recommended.

**Attribute(s):** NUpath Formal/Quant Reasoning

**MATH 1251. Calculus and Differential Equations for Biology 1. (4 Hours)**

Begins with the fundamentals of differential calculus and proceeds to the specific type of differential equation problems encountered in biological research. Presents methods for the solutions of these equations and how the exact solutions are obtained from actual laboratory data. Topics include differential calculus: basics, the derivative, the rules of differentiation, curve plotting, exponentials and logarithms, and trigonometric functions; using technology to understand derivatives; biological kinetics: zero- and first-order processes, processes tending toward equilibrium, bi- and tri-exponential processes, and biological half-life; differential equations: particular and general solutions to homogeneous and nonhomogeneous linear equations with constant coefficients, systems of two linear differential equations; compartmental problems: nonzero initial concentration, two-compartment series dilution, diffusion between compartments, population dynamics; and introduction to integration.

**Attribute(s):** NUpath Formal/Quant Reasoning

**MATH 1252. Calculus and Differential Equations for Biology 2. (4 Hours)**

Continues MATH 1251. Begins with the integral calculus and proceeds quickly to more advanced topics in differential equations. Introduces linear algebra and uses matrix methods to analyze functions of several variables and to solve larger systems of differential equations. Advanced topics in reaction kinetics are covered. The integral and differential calculus of functions of several variables is followed by the study of numerical methods in integration and solutions of differential equations. Provides a short introduction to probability. Covers Taylor polynomials and infinite series. Special topics include reaction kinetics: Michaelis-Menten processes, tracer experiments, and inflow and outflow through membranes.

**Prerequisite(s):** MATH 1251 with a minimum grade of D-

**Attribute(s):** NUpath Formal/Quant Reasoning

**MATH 1260. Math Fundamentals for Games. (4 Hours)**

Discusses linear algebra and vector geometry in two-, three-, and four-dimensional space. Examines length, dot product, and trigonometry. Introduces linear and affine transformations. Discusses complex numbers in two-space, cross product in three-space, and quaternions in four-space. Provides explicit formulas for rotations in three-space. Examines functions of one argument and treats exponentials and logarithms. Describes parametric curves in space. Discusses binomials, discrete probability, Bézier curves, and random numbers. Concludes with the concept of the derivative, the rules for computing derivatives, and the notion of a differential equation.

**Attribute(s):** NUpath Formal/Quant Reasoning

**MATH 1340. Intensive Calculus for Engineers. (6 Hours)**

Contains the material from the first semester of MATH 1341, preceded by material emphasizing the strengthening of precalculus skills. Topics include properties of exponential, logarithmic, and trigonometric functions; differential calculus; and introductory integral calculus.

**Attribute(s):** NUpath Formal/Quant Reasoning

**MATH 1341. Calculus 1 for Science and Engineering. (4 Hours)**

Covers definition, calculation, and major uses of the derivative, as well as an introduction to integration. Topics include limits; the derivative as a limit; rules for differentiation; and formulas for the derivatives of algebraic, trigonometric, and exponential/logarithmic functions. Also discusses applications of derivatives to motion, density, optimization, linear approximations, and related rates. Topics on integration include the definition of the integral as a limit of sums, antiderivatives, the fundamental theorem of calculus, and integration by substitution.

**Attribute(s):** NUpath Formal/Quant Reasoning

**MATH 1342. Calculus 2 for Science and Engineering. (4 Hours)**

Covers further techniques and applications of integration, infinite series, and introduction to vectors. Topics include integration by parts; numerical integration; improper integrals; separable differential equations; and areas, volumes, and work as integrals. Also discusses convergence of sequences and series of numbers, power series representations and approximations, 3D coordinates, parameterizations, vectors and dot products, tangent and normal vectors, velocity, and acceleration in space. Requires prior completion of MATH 1341 or permission of head mathematics advisor.

**Attribute(s):** NUpath Formal/Quant Reasoning

**MATH 1365. Introduction to Mathematical Reasoning. (4 Hours)**

Covers the basics of mathematical reasoning and problem solving to prepare incoming math majors for more challenging mathematical courses at Northeastern. Focuses on learning to write logically sound mathematical arguments and to analyze such arguments appearing in mathematical books and courses. Includes fundamental mathematical concepts such as sets, relations, and functions.

**MATH 1465. Intensive Mathematical Reasoning. (4 Hours)**

Introduces proofs and theoretical mathematics. Covers mathematical reasoning and problem solving to prepare math and computer science majors for theoretical mathematics and computer science courses. Focuses on learning to read and write logically sound mathematical arguments. Topics include logical reasoning, proof techniques, sets, the integers and modular arithmetic, relations, functions, cardinality, countable and uncountable sets, and elements of algebra and group theory. Intended for students seeking a more intensive version of MATH 1365.

**MATH 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MATH 2201. History of Mathematics. (4 Hours)**

Traces the development of mathematics from its earliest beginning to the present. Emphasis is on the contributions of various cultures including the Babylonians, Egyptians, Mayans, Greeks, Indians, and Arabs. Computations and constructions are worked out using the techniques and notations of these peoples. The role of mathematics in the development of science is traced throughout, including the contributions of Descartes, Kepler, Fermat, and Newton. More modern developments are discussed as time permits.

**Attribute(s):** NUpath Formal/Quant Reasoning, NUpath Interpreting Culture

**MATH 2280. Statistics and Software. (4 Hours)**

Provides an introduction to basic statistical techniques and the reasoning behind each statistical procedures. Covers appropriate statistical data analysis methods for applications in health and social sciences. Also examines a statistical package such as SPSS or SAS to implement the data analysis on computer. Topics include descriptive statistics, elementary probability theory, parameter estimation, confidence intervals, hypothesis testing, nonparametric inference, and analysis of variance and regression with a minimum of mathematical derivations.

**Attribute(s):** NUpath Analyzing/Using Data

**MATH 2321. Calculus 3 for Science and Engineering. (4 Hours)**

Extends the techniques of calculus to functions of several variables; introduces vector fields and vector calculus in two and three dimensions. Topics include lines and planes, 3D graphing, partial derivatives, the gradient, tangent planes and local linearization, optimization, multiple integrals, line and surface integrals, the divergence theorem, and theorems of Green and Stokes with applications to science and engineering and several computer lab projects. Prior completion of Calculus 2 is strongly recommended.

**Attribute(s):** NUpath Formal/Quant Reasoning

**MATH 2322. Recitation for MATH 2321. (0 Hours)**

Provides small-group discussion format to cover material in MATH 2321.

**MATH 2331. Linear Algebra. (4 Hours)**

Uses the Gauss-Jordan elimination algorithm to analyze and find bases for subspaces such as the image and kernel of a linear transformation. Covers the geometry of linear transformations: orthogonality, the Gram-Schmidt process, rotation matrices, and least squares fit. Examines diagonalization and similarity, and the spectral theorem and the singular value decomposition. Is primarily for math and science majors; applications are drawn from many technical fields. Computation is aided by the use of software such as Maple or MATLAB, and graphing calculators.

**Prerequisite(s):** MATH 1342 with a minimum grade of D- or MATH 1242 with a minimum grade of D- or MATH 1252 with a minimum grade of D- or CS 1800 with a minimum grade of D-

**MATH 2341. Differential Equations and Linear Algebra for Engineering. (4 Hours)**

Studies ordinary differential equations, their applications, and techniques for solving them including numerical methods (through computer labs using MS Excel and MATLAB), Laplace transforms, and linear algebra. Topics include linear and nonlinear first- and second-order equations and applications include electrical and mechanical systems, forced oscillation, and resonance. Topics from linear algebra, such as matrices, row-reduction, vector spaces, and eigenvalues/eigenvectors, are developed and applied to systems of differential equations. Prior completion of Calculus 2 is strongly recommended.

**MATH 2342. Recitation for MATH 2341. (0 Hours)**

Provides small-group discussion format to cover material in MATH 2341.

**MATH 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MATH 2991. Research in Mathematics. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated seven times.

**MATH 3000. Co-op and Experiential Learning Reflection Seminar 1. (1 Hour)**

Intended for math majors who have completed their first co-op assignment or other integrated experiential learning component of the NU Core. The goal is to examine the mathematical problems encountered in these experiences and relate them to courses already taken and to the student's future program. Faculty members and other guests contribute to the discussion. Grades are determined by the student's participation in the course and the completion of a final paper.

**MATH 3081. Probability and Statistics. (4 Hours)**

Focuses on probability theory. Topics include sample space; conditional probability and independence; discrete and continuous probability distributions for one and for several random variables; expectation; variance; special distributions including binomial, Poisson, and normal distributions; law of large numbers; and central limit theorem. Also introduces basic statistical theory including estimation of parameters, confidence intervals, and hypothesis testing.

**Prerequisite(s):** MATH 1342 with a minimum grade of D- or MATH 1252 with a minimum grade of D- or MATH 1242 with a minimum grade of D-  
**Attribute(s):** NUpath Analyzing/Using Data

**MATH 3082. Recitation for MATH 3081. (0 Hours)**

Provides small-group discussion format to cover material in MATH 3081.

**MATH 3090. Exploration of Modern Mathematics. (4 Hours)**

Offers students a research-minded, elementary, and intuitive introduction to the interplay between algebra, geometry, analysis, and topology using an interactive and experimental approach. Intended for math majors, math combined majors, and students pursuing a math minor; all others should obtain permission of instructor.

**Prerequisite(s):** MATH 1242 with a minimum grade of D- or MATH 1252 with a minimum grade of D- or MATH 1342 with a minimum grade of D-

**MATH 3150. Real Analysis. (4 Hours)**

Provides the theoretical underpinnings of calculus and the advanced study of functions. Emphasis is on precise definitions and rigorous proof. Topics include the real numbers and completeness, continuity and differentiability, the Riemann integral, the fundamental theorem of calculus, inverse function and implicit function theorems, and limits and convergence. Required of all mathematics majors.

**Prerequisite(s):** (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C ); (MATH 1365 with a minimum grade of D- or MATH 1465 with a minimum grade of D- ; MATH 2331 with a minimum grade of D- )

**Attribute(s):** NUpath Writing Intensive

**MATH 3175. Group Theory. (4 Hours)**

Presents basic concepts and techniques of the group theory: symmetry groups, axiomatic definition of groups, important classes of groups (abelian groups, cyclic groups, additive and multiplicative groups of residues, and permutation groups), Cayley table, subgroups, group homomorphism, cosets, the Lagrange theorem, normal subgroups, quotient groups, and direct products. Studies structural properties of groups. Possible applications include geometry, number theory, crystallography, physics, and combinatorics.

**Prerequisite(s):** MATH 2321 with a minimum grade of D- ; MATH 2331 with a minimum grade of D-

**MATH 3181. Advanced Probability and Statistics. (4 Hours)**

Focuses on probability theory needed to prepare students for research and advanced coursework in the physical and data sciences. Examples and homework problems come from physics, chemistry, biology, computer science, data science, and electrical engineering. Topics include sample spaces; conditional probability and independence; discrete and continuous probability distributions for one and for several random variables; expectation; variance; special distributions including binomial, Poisson, and normal distributions; law of large numbers; and the central limit theorem. Introduces basic statistical theory including estimation of parameters, confidence intervals, and hypothesis testing. This course is proof-based and emphasizes developing students' abilities in mathematical proof writing.

**Prerequisite(s):** MATH 2321 with a minimum grade of D-

**MATH 3275. Advanced Group Theory. (4 Hours)**

Serves as an accelerated introduction to the theory of groups, intended for students who wish to take a more advanced version of MATH 3175. Prior knowledge of group theory is not assumed. Introduces homomorphisms, subgroups, normal subgroups, quotient groups, and group actions, illustrated with a variety of examples. Subsequent topics include the class equation, simple groups, the Sylow theorems, and their applications to the classification of finite simple groups. Discusses classical matrix groups, with an emphasis on SU(2) and SO(3) as fundamental examples, and introduces the notion of a Lie algebra. Develops representation theory of finite groups and its correspondence to the representation theory of compact Lie groups sketched, again using SU(2) as an example. Students not meeting course prerequisites may seek permission of instructor.

**Prerequisite(s):** MATH 1365 with a minimum grade of B ; MATH 2331 with a minimum grade of B

**MATH 3331. Differential Geometry. (4 Hours)**

Studies differential geometry, focusing on curves and surfaces in 3D space. The material presented here can serve as preparation for a more advanced course in Riemannian geometry or differential topology.

**Prerequisite(s):** MATH 2321 with a minimum grade of D- ; MATH 2331 with a minimum grade of D-

**MATH 3341. Dynamical Systems. (4 Hours)**

Studies dynamical systems and their applications as they arise from differential equations. Solutions are obtained and analyzed as parameterized curves in the plane and used as a means of understanding the evolution of physical processes. Applications include conservative systems, predator-prey interactions, and cooperation and competition of species.

**Prerequisite(s):** MATH 2341 with a minimum grade of D-

**MATH 3527. Number Theory 1. (4 Hours)**

Introduces number theory. Topics include linear diophantine equations, congruences, design of magic squares, Fermat's little theorem, Euler's formula, Euler's phi function, computing powers and roots in modular arithmetic, the RSA encryption system, primitive roots and indices, and the law of quadratic reciprocity. As time permits, may cover diophantine approximation and Pell's equation, elliptic curves, points on elliptic curves, and Fermat's last theorem.

**Prerequisite(s):** MATH 1342 with a minimum grade of D- or MATH 1242 with a minimum grade of D- or MATH 1252 with a minimum grade of D-

**MATH 3530. Numerical Analysis. (4 Hours)**

Considers various problems including roots of nonlinear equations; simultaneous linear equations: direct and iterative methods of solution; eigenvalue problems; interpolation; and curve fitting. Emphasizes understanding issues rather than proving theorems or coming up with numerical recipes.

**Prerequisite(s):** MATH 2331 with a minimum grade of D- or MATH 2341 with a minimum grade of D-

**MATH 3533. Combinatorial Mathematics. (4 Hours)**

Introduces techniques of mathematical proofs including mathematical induction. Explores various techniques for counting such as permutation and combinations, inclusion-exclusion principle, recurrence relations, generating functions, Polya enumeration, and the mathematical formulations necessary for these techniques including elementary group theory and equivalence relations.

**Prerequisite(s):** MATH 1342 with a minimum grade of D- or MATH 1242 with a minimum grade of D- or MATH 1252 with a minimum grade of D-

**MATH 3535. Numerical Methods with Applications to Differential Equations. (4 Hours)**

Covers numerical methods to solve ordinary differential equations that are otherwise not solvable using exact methods and that are useful in a variety of applications drawn from classical areas of science and engineering. Studies examples classified as initial and boundary value problems from fluid mechanics and heat transfer. The topics are of fundamental importance in many branches of applied mathematics, physical sciences, and engineering. Possible topics also include the finite element method, which is very useful in structural analysis involving complex geometry.

**Prerequisite(s):** MATH 2341 with a minimum grade of C-

**MATH 3543. Dynamics, Chaos, and Fractals. (4 Hours)**

Introduces one-dimensional discrete real and complex dynamics, chaotic dynamics, and fractals, with an emphasis on computational and graphical exploration. Studies orbits and periodic iteration behavior of real and complex-valued function, attracting cycles, itineraries, symbolic dynamics, chaos, classical fractal constructions, Minkowski dimension, Julia sets, and the Mandelbrot set.

**Prerequisite(s):** MATH 1342 with a minimum grade of D-

**MATH 3545. Introduction to Graph Theory. (4 Hours)**

Offers a mathematical introduction to networks and graphs, which find applications in social and natural sciences. Introduces paths, cycles, trees, bipartite graphs, matchings, colorings, connectivity, and network flows. Discusses special cases of planar, Eulerian, and Hamiltonian graphs; Tait's theorem; and possible advanced topics. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** MATH 1365 with a minimum grade of C- or MATH 2310 with a minimum grade of C- or MATH 3533 with a minimum grade of C- or CS 1800 with a minimum grade of C- or CS 3800 with a minimum grade of C-

**MATH 3560. Geometry. (4 Hours)**

Studies classical geometry and symmetry groups of geometric figures, with an emphasis on Euclidean geometry. Teaches how to formulate mathematical propositions precisely and how to construct and understand mathematical proofs. Provides a line between classical and modern geometry with the aim of preparing students for further study in group theory and differential geometry.

**Prerequisite(s):** MATH 2331 with a minimum grade of D- or MATH 2341 with a minimum grade of D-

**MATH 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MATH 4020. Research Capstone. (4 Hours)**

Offers students the experience of engaging in mathematical research that builds upon the math courses that they have taken and, possibly, their co-op assignments. Requires students to complete a research project of their own choosing. Focus is on the project and on the students presenting their work. Also requires students to write a reflection paper. Intended for juniors or seniors with experience or interest in mathematics research. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** MATH 3150 with a minimum grade of D- ; MATH 3175 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**MATH 4025. Applied Mathematics Capstone. (4 Hours)**

Emphasizes the use of a variety of methods—such as optimization, differential equations, probability, and statistics—to study problems that arise in epidemiology, finance, and other real-world settings. Course work includes assigned exercises, a long-term modeling project on a topic of the student's choosing, and a reflection paper.

**Prerequisite(s):** MATH 3081 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**MATH 4527. Number Theory 2. (4 Hours)**

Continues MATH 3527. Topics include Diophantine approximation, the Gaussian integers, irrational numbers and transcendental numbers, nonlinear polynomial congruences, systems of linear congruences, mobius inversion, elliptic curves, modular curves, modular forms, and L-functions.

**Prerequisite(s):** (MATH 3527 with a minimum grade of D- or MATH 4575 with a minimum grade of D- ); MATH 3175 with a minimum grade of D-

**MATH 4545. Fourier Series and PDEs. (4 Hours)**

Provides a first course in Fourier series, Sturm-Liouville boundary value problems, and their application to solving the fundamental partial differential equations of mathematical physics: the heat equation, the wave equation, and Laplace's equation. Green's functions are also introduced as a means of obtaining closed-form solutions.

**Prerequisite(s):** MATH 2351 with a minimum grade of D- or MATH 2341 with a minimum grade of D-

**MATH 4555. Complex Variables. (4 Hours)**

Provides an introduction to the analysis of functions of a complex variable. Starting with the algebra and geometry of complex numbers, basic derivative and contour integral properties are developed for elementary algebraic and transcendental functions as well as for other analytic functions and functions with isolated singularities. Power and Laurent series representations are given. Classical integral theorems, residue theory, and conformal mapping properties are studied. Applications of harmonic functions are presented as time permits.

**Prerequisite(s):** MATH 2321 with a minimum grade of D-

**MATH 4565. Topology. (4 Hours)**

Introduces the student to fundamental notions of topology. Introduces basic set theory, then covers the foundations of general topology (axioms for a topological space, continuous functions, homeomorphisms, metric spaces, the subspace, product and quotient topologies, connectedness, compactness, and the Hausdorff condition). Also introduces algebraic and geometric topology (homotopy, covering spaces, fundamental groups, graphs, surfaces, and manifolds) and applications. Other topics are covered if time permits.

**Prerequisite(s):** MATH 3150 with a minimum grade of D-

**MATH 4570. Matrix Methods in Data Analysis and Machine Learning. (4 Hours)**

Introduces concepts and methods of linear algebra for understanding and creating machine learning and deep learning algorithms. Topics include various matrix factorizations, symmetric positive definite matrices, inner product spaces, matrix calculus, applications to probability and statistics, and optimization in high-dimensional spaces. Explores the mathematics behind data analysis, machine learning, and deep learning, including gradient descents, Newton's methods, principal components analysis, linear regression and linear methods in classification, neural networks, and convolutional neural networks. Offers students opportunities to learn and practice Python skills with labs and the final project.

**Prerequisite(s):** MATH 2331 with a minimum grade of D-

**MATH 4571. Advanced Linear Algebra. (4 Hours)**

Provides a more detailed study of linear transformations and matrices: LU factorization, QR factorization, Spectral theorem and singular value decomposition, Jordan form, positive definite matrices, quadratic forms, partitioned matrices, and norms and numerical issues. Topics and emphasis change from year to year.

**Prerequisite(s):** MATH 2331 with a minimum grade of D-

**MATH 4575. Introduction to Cryptography. (4 Hours)**

Presents the mathematical foundations of cryptology, beginning with the study of divisibility of integers, the Euclidian Algorithm, and an analysis of the Extended Euclidian Algorithm. Includes a short study of groups, semigroups, residue class rings, fields, Fermat's Little Theorem, Chinese Remainder Theorem, polynomials over fields, and the multiplicative group of residues modulo a prime number. Introduces fundamental notions used to describe encryption schemes together with examples, which include affine linear ciphers and cryptanalysis and continues with probability and perfect secrecy. Presents the Data Encryption Standard (DES) and culminates in the study of the Advanced Encryption Standard (AES), the standard encryption scheme in the United States since 2001.

**Prerequisite(s):** MATH 2331 with a minimum grade of D- or MATH 3175 with a minimum grade of D- or MATH 3527 with a minimum grade of D-

**MATH 4576. Rings and Fields. (4 Hours)**

Introduces commutative rings, ideals, integral domains, fields, and the theory of extension fields. Topics include Gaussian integers, Galois groups, and the fundamental theorem of Galois theory. Applications include the impossibility of angle-trisection and the general insolvability of fifth- and higher-degree polynomials. Other topics are covered as time permits.

**Prerequisite(s):** MATH 3175 with a minimum grade of D-

**MATH 4577. Commutative Algebra. (4 Hours)**

Introduces the basics of commutative algebra. Emphasizes rigorously building the mathematical background needed for studying this subject in more depth. Seeks to prepare students for more advanced classes in algebraic geometry, robotics, invariant theory of finite groups, and cryptography. Covers geometry, algebra, and algorithms; Grobner bases; elimination theory; the algebra-geometry dictionary; robotics and automatic geometric theorem proving.

**Prerequisite(s):** (MATH 2331 with a minimum grade of C+ ; MATH 1365 with a minimum grade of C+) or MATH 3175 with a minimum grade of C+ or MATH 4576 (may be taken concurrently) with a minimum grade of C+

**MATH 4581. Statistics and Stochastic Processes. (4 Hours)**

Continues topics introduced in MATH 3081. The first part of the course covers classical procedures of statistics including the t-test, linear regression, and the chi-square test. The second part provides an introduction to stochastic processes with emphasis on Markov chains, random walks, and Brownian motion, with applications to modeling and finance.

**Prerequisite(s):** MATH 3081 with a minimum grade of D- or MATH 3181 with a minimum grade of D-

**MATH 4606. Mathematical and Computational Methods for Physics. (4 Hours)**

Covers advanced mathematical methods topics that are commonly used in the physical sciences, such as complex calculus, Fourier transforms, special functions, and the principles of variational calculus. Applies these methods to computational simulation and modeling exercises. Introduces basic computational techniques and numerical analysis, such as Newton's method, Monte Carlo integration, gradient descent, and least squares regression. Uses a simple programming language, such as MATLAB, for the exercises.

**Prerequisite(s):** PHYS 2303 with a minimum grade of D- ; MATH 2321 with a minimum grade of D- ; (MATH 2341 with a minimum grade of D- or MATH 2351 with a minimum grade of D- )

**MATH 4681. Probability and Risks. (4 Hours)**

Reviews main probability and statistics concepts from the point of view of decision risks in actuarial and biomedical contexts, including applications of normal approximation for evaluating statistical risks. Also examines new topics, such as distribution of extreme values and nonparametric statistics with examples. May be especially useful for students preparing for the first actuarial exam on probability and statistics.

**Prerequisite(s):** MATH 3081 with a minimum grade of D- or MATH 3181 with a minimum grade of D-

**MATH 4682. Theory of Interest and Basics of Life Insurance 1. (4 Hours)**

Reviews basic financial instruments in the presence of interest rates, including the measurement of interest and problems in interest (equations of value, basic and more general annuities, yield rates, amortization schedules, bonds and other securities). Examines numerous practical applications. Also introduces problems of life insurance with examples. May be especially useful for students preparing for the second actuarial exam on theory of interest.

**Prerequisite(s):** MATH 3081 with a minimum grade of D- or MATH 3181 with a minimum grade of D-

**MATH 4683. Financial Derivatives. (4 Hours)**

Presents the mathematical basis of actuarial models and their application to insurance and other financial risks. Includes but is not limited to financial derivatives such as options and futures. Techniques and applications may be useful for students preparing for actuarial Exam 3F (Society of Actuaries Exam MFE).

**Prerequisite(s):** MATH 4581 with a minimum grade of D-

**MATH 4684. Theory of Interest and Basics of Life Insurance 2. (4 Hours)**

Reviews actuarial models for life insurance, including survival models, life tables, life insurance, life annuities, premium and policy values, multiple state models, joint-life and last survivor models, pensions, and emerging costs for life insurance. Designed to be especially useful for students preparing for the fourth actuarial exam, LTAM (Long-Term Actuarial Mathematics), of the Society of Actuaries.

**Prerequisite(s):** MATH 4682 with a minimum grade of C-

**MATH 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**Prerequisite(s):** MATH 3081 with a minimum grade of D-

**MATH 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** MATH 4970 with a minimum grade of D-

**MATH 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MATH 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**MATH 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**MATH 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**MATH 4996. Experiential Education Directed Study. (4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major. Restricted to mathematics majors who are using it to fulfill their experiential education requirement; for these students it may count as a mathematics elective, subject to approval by instructor and adviser. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience, NUpath Writing Intensive

**MATH 5001. Accelerated Linear Algebra. (2 Hours)**

Offers an intensive exploration of linear algebra. Covers linear algebra concepts at an accelerated pace including vector spaces, linear transformations, matrix operations, eigenvalues and eigenspaces, inner product spaces, orthogonal basis, least squares, positive semidefinite matrices, and singular value decompositions. Includes applications to statistics, dynamical systems, and machine learning.

**MATH 5002. Accelerated Multivariable Calculus. (2 Hours)**

Offers an intensive exploration of multivariable calculus. Covers vector calculus concepts at an accelerated pace including partial derivatives, level sets, gradient vectors, optimizations, Lagrange multipliers, multiple integrals, vector fields, line integrals, and surface integrals. Includes applications to statistics, engineering, and machine learning.

**MATH 5003. Accelerated Probability and Statistics. (2 Hours)**

Offers an intensive exploration of probability and statistics including both theoretical concepts and practical applications. Covers discrete and continuous random variables, probability distributions, expectation and variance, central limit theorem, estimation theory, maximum likelihood estimation, and hypothesis testing. Includes applications to machine learning and solving real-world problems.

**MATH 5010. Foundations of Statistical Theory and Probability. (4 Hours)**

Presents a comprehensive foundational overview of the probability theory and mathematical statistics critical to various methodologies needed to perform and interpret a statistical analysis. Explores probability distributions and the theoretical justifications around common statistical measures such as means, variances, and expected values. Introduces likelihood and Bayesian theory as tools to derive parameter estimates and begin to make inferences. Culminates with formal procedures for statistical inference including hypothesis testing, the construction of confidence intervals and credible intervals, and calculations of power and sample size. All topics are grounded in theory, with appropriate practice using a programming language and real-world datasets to communicate and visualize data and results.

**MATH 5101. Analysis 1: Functions of One Variable. (4 Hours)**

Offers a rigorous, proof-based introduction to mathematical analysis and its applications. Topics include metric spaces, convergence, compactness, and connectedness; continuous and uniformly continuous functions; derivatives, the mean value theorem, and Taylor series; Riemann integration and the fundamental theorem of calculus; interchanging limit operations; sequences of functions and uniform convergence; Arzelà-Ascoli and Stone-Weierstrass theorems; inverse and implicit function theorems; successive approximations and existence/uniqueness for ordinary differential equations; linear operators on finite-dimensional vector spaces and applications to systems of ordinary differential equations. Provides a series of computer projects that further develop the connections between theory and applications. Requires permission of instructor and head advisor for undergraduate students.

**MATH 5102. Analysis 2: Functions of Several Variables. (4 Hours)**

Continues MATH 5101. Studies basics of analysis in several variables. Topics include derivative and partial derivatives; the contraction principle; the inverse function and implicit function theorems; derivatives of higher order; Taylor formula in several variables; differentiation of integrals depending on parameters; integration of functions of several variables; change of variables in integrals; differential forms and their integration over simplexes and chains; external multiplication of forms; differential of forms; Stokes' formula; set functions; Lebesgue measure; measure spaces; measurable functions; integration; comparison with the Riemann integral; L<sub>2</sub> as a Hilbert space; and Parseval theorem and Riesz-Fischer theorem. Requires permission of instructor and head advisor for undergraduate students.

**MATH 5110. Applied Linear Algebra and Matrix Analysis. (4 Hours)**

Offers a robust introduction to the basic results of linear algebra on real and complex vector spaces with applications to differential equations and Markov chains. Introduces theoretical results along the way, along with matrix analysis, eigenvalue analysis, and spectral decomposition. Includes a significant computational component, focused on applications of linear algebra to mathematical modeling.

**MATH 5111. Algebra 1. (4 Hours)**

Discusses fundamentals of the theory of groups and some applications in Galois theory. Topics may include quotient groups and isomorphism theorems; group actions and Sylow theory; simplicity and solvability; permutations and the simplicity of the higher alternating groups; fields and polynomial rings; splitting fields; the Galois correspondence; computations of Galois groups; and applications of Galois theory, including non-solvability of polynomials by radicals.

**MATH 5112. Algebra 2. (4 Hours)**

Provides a comprehensive introduction to commutative algebra: rings and modules. Topics in commutative ring theory include ideals, prime and maximal ideals, ring homomorphisms, Euclidean domains, principal ideal domains, unique factorization domains, fields of quotients, polynomial rings, irreducibility criteria, and the Chinese Remainder Theorem. Topics in module theory include module homomorphisms, the structure theorem for modules over a PID and applications, and the Jordan and rational canonical forms.

**MATH 5122. Geometry 1. (4 Hours)**

Covers differentiable manifolds, such as tangent bundles, tensor bundles, vector fields, Frobenius integrability theorem, differential forms, Stokes' theorem, and de Rham cohomology; and curves and surfaces, such as elementary theory of curves and surfaces in  $R^3$ , fundamental theorem of surfaces in  $R^3$ , surfaces with constant Gauss or mean curvature, and Gauss-Bonnet theorem for surfaces. Requires permission of instructor and head advisor for undergraduate students.

**Prerequisite(s):** MATH 5101 with a minimum grade of C- ; MATH 5111 with a minimum grade of C-

**MATH 5131. Introduction to Mathematical Methods and Modeling. (4 Hours)**

Presents mathematical methods emphasizing applications. Uses ordinary and partial differential equations to model the evolution of real-world processes. Topics chosen illustrate the power and versatility of mathematical methods in a variety of applied fields and include population dynamics, drug assimilation, epidemics, spread of pollutants in environmental systems, competing and cooperating species, and heat conduction. Requires students to complete a math-modeling project. Requires undergraduate-level course work in ordinary and partial differential equations.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**MATH 5352. Quantum Computation and Information. (4 Hours)**

Introduces the foundations of quantum computation and information, including finite dimensional quantum mechanics, gates and circuits, quantum algorithms, quantum noise, and error-correcting codes. Assumes a working knowledge of linear algebra and matrix analysis, but no prior experience with quantum theory or algorithms is required.

**MATH 6000. Professional Development for Co-op. (1 Hour)**

Introduces the cooperative education program. Offers students an opportunity to develop job-search and career-management skills; to assess their workplace skills, interests, and values and to discuss how they impact personal career choices; to prepare a professional resumé; and to learn proper interviewing techniques. Explores career paths, choices, professional behaviors, work culture, and career decision making.

**MATH 6241. Stochastic Processes. (2 Hours)**

Reviews probability theory; conditional probability and expectations; discrete-time and continuous-time Markov chains; Poisson process and exponential distributions (renewal theory and its applications, queueing theory); Brownian motion; and stochastic systems. Examines applications to Monte Carlo simulation and various real-world scenarios. Involves practical applications through computer simulations by a language programming and/or project in real-world problems such as finance, biostatistics, machine learning, etc.

**Prerequisite(s):** MATH 5010 with a minimum grade of C-

**MATH 6243. Statistical Learning. (4 Hours)**

Presents fundamental principles of machine learning from a statistical standpoint. Focuses on supervised learning, including regression and classification methods. Topics include linear and polynomial regression, logistic regression, and linear discriminant analysis; cross-validation and the bootstrap, model selection, and regularization methods (ridge and lasso); nonlinear models, splines, and generalized additive models; tree-based methods, random forests, and boosting; and support-vector machines. Examines methods used to learn from data taking a deeper look at algorithms that may appear to be different but actually use similar principles. Discusses some unsupervised learning methods principal components and clustering. Uses a programming language to fit these models using modern techniques for visualization and reporting.

**Prerequisite(s):** MATH 5010 with a minimum grade of C-

**MATH 6910. Master's Project. (1 Hour)**

Offers the opportunity to conduct an experimental capstone project or a theoretical work project under faculty supervision. Students identify skills learned in the degree program and articulate their skills, knowledge, and abilities as a part of the course, as they transition to the field or advance in the field. May be repeated once.

**MATH 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**MATH 6955. Co-op Work Experience Abroad - Half Time. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad.

**MATH 6961. Internship. (1-4 Hours)**

Offers students an opportunity for internship work. May be repeated without limit.

**MATH 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MATH 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**MATH 6965. Co-op Work Experience Abroad. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated without limit.

**MATH 7202. Partial Differential Equations 1. (4 Hours)**

Introduces partial differential equations, their theoretical foundations, and their applications, which include optics, propagation of waves (light, sound, and water), electric field theory, and diffusion. Topics include first-order equations by the method of characteristics; linear, quasilinear, and nonlinear equations; applications to traffic flow and geometrical optics; principles for higher-order equations; power series and Cauchy-Kowalevski theorem; classification of second-order equations; linear equations and generalized solutions; wave equations in various space dimensions; domain of dependence and range of influence; Huygens' principle; conservation of energy, dispersion, and dissipation; Laplace's equation; mean values and the maximum principle; the fundamental solution, Green's functions, and Poisson kernels; applications to physics; properties of harmonic functions; the heat equation; eigenfunction expansions; the maximum principle; Fourier transform and the Gaussian kernel; regularity of solutions; scale invariance and the similarity method; Sobolev spaces; and elliptic regularity.

**MATH 7203. Numerical Analysis 1. (4 Hours)**

Introduces methods and techniques used in contemporary number crunching. Covers floating-point computations involving scalars, vectors, and matrices; solvers for sparse and dense linear systems; matrix decompositions; integration of functions and solutions of ordinary differential equations (ODEs); and Fast Fourier transform. Focuses on finding solutions to practical, real-world problems. Knowledge of programming in Matlab is assumed. Knowledge of other programming languages would be good but not required.

**MATH 7204. Complex Analysis. (4 Hours)**

Introduces complex analysis in one complex variable. Topics include holomorphic functions of one complex variable and their basic properties; geometrical and hydrodynamical interpretations of holomorphic functions; hyperbolic plane and its group of automorphisms; Cauchy-Riemann equations; Cauchy integral formula; Taylor series of holomorphic functions; Weierstrass and Runge theorems; Laurent series and classification of singular points of holomorphic functions; meromorphic functions; residues and their applications to the calculation of integrals; analytic continuation and Riemann surfaces; maximum principle and Schwarz lemma; the Riemann mapping theorem; elements of the theory of elliptic functions; entire functions, their growth, and distribution of zeros; asymptotic expansions; and Laplace method and saddle point method for finding asymptotics of integrals.

**Prerequisite(s):** MATH 5102 (may be taken concurrently) with a minimum grade of C- ; MATH 5111 (may be taken concurrently) with a minimum grade of C-

**MATH 7205. Numerical Analysis 2. (4 Hours)**

Covers numerical analysis and scientific computation. Topics include numerical solutions of ordinary differential equations (ODEs) and one-dimensional boundary value problems; solving partial differential equations (PDEs) using modal expansions, finite-difference, and finite-element methods; stability of PDE algorithms; elementary computational geometry and mesh generation; unconstrained optimization with application to data modeling; and constrained optimization of convex functions: linear and quadratic programming. Focuses on techniques commonly used for data fitting and solving problems from engineering and physical science. Knowledge of programming in MATLAB is assumed. Knowledge of other programming languages beneficial but not required.

**MATH 7207. Algorithms for Optimization. (4 Hours)**

Covers algorithms used to solve optimization problems, specifically algorithms used to optimize a set of continuous design variables. Presents classic algorithms such as gradient descent, Newton's method, simulated annealing, the simplex method, and others. Studies algorithms for both unconstrained and constrained optimization. Discusses optimization of both convex and nonconvex objective functions. Emphasizes hands-on and practical implementation of the algorithms presented by writing computer programs. Uses applications from business and industry to illustrate how the algorithms work and when they should be applied.

**MATH 7221. Topology 2. (4 Hours)**

Continues MATH 5121. Introduces homology and cohomology theory. Studies singular homology, homological algebra (exact sequences, axioms), Mayer-Vietoris sequence, CW-complexes and cellular homology, calculation of homology of cellular spaces, and homology with coefficients. Moves on to cohomology theory, universal coefficients theorems, Bockstein homomorphism, Künneth formula, cup and cap products, Hopf invariant, Borsuk-Ulam theorem, and Brouwer and Lefschetz-Hopf fixed-point theorems. Ends with a study of duality in manifolds including orientation bundle, Poincaré duality, Lefschetz duality, Alexander duality, Euler class, Lefschetz numbers, Gysin sequence, intersection form, and signature.

**MATH 7223. Riemannian Optimization. (4 Hours)**

Offers a self-contained introduction to optimization on smooth manifolds. Covers both theoretical foundations and practical computational methods that students can apply to their own work. Introduces the theory of Riemannian geometry. Emphasizes those elements that are relevant for the construction of optimization algorithms (tensor fields, metrics, connections, geodesics, retractions, and transporters). Applies this geometric machinery to devise first- and second-order smooth optimization methods on generic Riemannian manifolds. Focuses on the development of practical computational techniques, with applications to robotics, computer vision, and machine learning.

**MATH 7233. Graph Theory. (4 Hours)**

Covers fundamental concepts in graph theory. Topics include adjacency and incidence matrices, paths and connectedness, and vertex degrees and counting; trees and distance including properties of trees, distance in graphs, spanning trees, minimum spanning trees, and shortest paths; matchings and factors including matchings in bipartite graphs, Hall's matching condition, and min-max theorems; connectivity, such as vertex connectivity, edge connectivity, k-connected graphs, and Menger's theorem; network flows including maximum network flow, and integral flows; vertex colorings, such as upper bounds, Brooks' theorem, graphs with large chromatic number, and critical graphs; Eulerian circuits and Hamiltonian cycles including Euler's theorem, necessary conditions for Hamiltonian cycles, and sufficient conditions; planar graphs including embeddings and Euler's formula, characterization of planar graphs (Kuratowski's theorem); and Ramsey theory including Ramsey's theorem, Ramsey numbers, and graph Ramsey theory.

**MATH 7234. Optimization and Complexity. (4 Hours)**

Offers theory and methods of maximizing and minimizing solutions to various types of problems. Studies combinatorial problems including mixed integer programming problems (MIP); pure integer programming problems (IP); Boolean programming problems; and linear programming problems (LP). Topics include convex subsets and polyhedral subsets of n-space; relationship between an LP problem and its dual LP problem, and the duality theorem; simplex algorithm, and Kuhn-Tucker conditions for optimality for nonlinear functions; and network problems, such as minimum cost and maximum flow-minimum cut. Also may cover complexity of algorithms; problem classes P (problems with polynomial-time algorithms) and NP (problems with nondeterministic polynomial-time algorithms); Turing machines; and NP-completeness of traveling salesman problem and other well-known problems.

**MATH 7235. Discrete Geometry 1. (4 Hours)**

Discusses basic concepts in discrete and combinatorial geometry. Topics may include convex sets and their basic properties; theorems of Helly, Radon, and Carathéodory; separation theorems for convex bodies; convex polytopes; face vectors; Euler's theorem and Dehn-Sommerville equations; upper bound theorem; symmetry groups; regular polytopes and tessellations; reflection groups and Coxeter groups; regular tessellations on surfaces; abstract regular and chiral polytopes; and other topics at instructor's discretion.

**MATH 7237. Theory of Optimization. (4 Hours)**

Focuses on the rigorous mathematical theory pertaining to finite-dimensional optimization including convex analysis, optimality conditions, Lagrangean duality, and convergence rates of optimization algorithms. Topics include convex sets, cones, polar cones, dual cones, extreme points, polyhedra, convex functions, epigraphs, subgradients, convex conjugation, Fenchel-Moreau theorem, necessary and sufficient conditions for optimality, tangent cones, constraint qualification, Slater's condition, Karush-Kuhn-Tucker conditions, Lagrange multipliers, primal problems and dual problems, semidefinite programming, Farkas' lemma, theorems of the alternative, gradient descent, Newton's method, and convergence rates.

**MATH 7241. Probability 1. (4 Hours)**

Offers an introductory course in probability theory, with an emphasis on problem solving and modeling. Starts with basic concepts of probability spaces and random variables, and moves on to the classification of Markov chains with applications. Other topics include the law of large numbers and the central limit theorem, with applications to the theory of random walks and Brownian motion.

**MATH 7243. Machine Learning and Statistical Learning Theory 1. (4 Hours)**

Introduces both the mathematical theory of learning and the implementation of modern machine-learning algorithms appropriate for data science. Modeling everything from social organization to financial predictions, machine-learning algorithms allow us to discover information about complex systems, even when the underlying probability distributions are unknown. Algorithms discussed include regression, decision trees, clustering, and dimensionality reduction. Offers students an opportunity to learn the implications of the mathematical choices underpinning the use of each algorithm, how the results can be interpreted in actionable ways, and how to apply their knowledge through the analysis of a variety of data sets and models.

**MATH 7301. Functional Analysis. (4 Hours)**

Provides an introduction to essential results of functional analysis and some of its applications. The main abstract facts can be understood independently. Proof of some important basic theorems about Hilbert and Banach spaces (Hahn-Banach theorem, open mapping theorem) are omitted, in order to allow more time for applications of the abstract techniques, such as compact operators; Peter-Weyl theorem for compact groups; spectral theory; Gelfand's theory of commutative C\*-algebras; mean ergodic theorem; Fourier transforms and Sobolev embedding theorems; and distributions and elliptic operators.

**Prerequisite(s):** MATH 5102 with a minimum grade of C- or MATH 5102 with a minimum grade of C-

**MATH 7311. Commutative Algebra. (4 Hours)**

Introduces some of the main tools of commutative algebra, particularly those tools related to algebraic geometry. Topics include prime ideals, localization, and integral extensions; primary decomposition; Krull dimension; chain conditions, and Noetherian and Artinian modules; and additional topics from ring and module theory as time permits.

**Prerequisite(s):** MATH 5111 with a minimum grade of C-

**MATH 7312. Lie Theory. (4 Hours)**

Examines Lie groups and Lie algebras, the exponential map, examples, basic structure theorems, representation theory, and applications. Additional topics vary with the instructor and may include infinite-dimensional Lie algebras, algebraic groups, finite groups of Lie type, geometry, and analysis of homogenous spaces.

**Prerequisite(s):** MATH 5112 with a minimum grade of C-

**MATH 7314. Algebraic Geometry 1. (4 Hours)**

Concentrates on the techniques of algebraic geometry arising from commutative and homological algebra, beginning with a discussion of the basic results for general algebraic varieties, and developing the necessary commutative algebra as needed. Considers affine and projective varieties, morphisms of algebraic varieties, regular and singular points, and normality. Discusses algebraic curves, with a closer look at the relations between the geometry, algebra, and function theories. Examines the Riemann-Roch theorem with its many applications to the study of the geometry of curves. Studies the singularities of curves.

**Prerequisite(s):** MATH 5112 with a minimum grade of C-

**MATH 7315. Algebraic Number Theory. (4 Hours)**

Covers rings of integers, Dedekind domains, factorization of ideals, ramification, and the decomposition and inertia subgroups; units in rings of integers, Minkowski's geometry of numbers, and Dirichlet's unit theorem; and class groups, zeta functions, and density sets of primes.

**Prerequisite(s):** MATH 5111 with a minimum grade of C-

**MATH 7316. Lie Algebras. (4 Hours)**

Introduces notions of solvable and nilpotent Lie algebras. Covers semisimple Lie algebras: Killing form criterion, Cartan decomposition, root systems, Weyl groups, Dynkin diagrams, and weights. Discusses universal enveloping algebra, PBW theorem, representations of semisimple Lie algebras, weight spaces, highest weight modules, multiplicities, characters, and the Weyl character formula.

**Prerequisite(s):** MATH 5111 with a minimum grade of C- ; MATH 5112 (may be taken concurrently) with a minimum grade of C-

**MATH 7320. Modern Algebraic Geometry. (4 Hours)**

Introduces students to modern techniques of algebraic geometry, including those coming from Lie theory, symplectic and differential geometry, complex analysis, and number theory. Covers subjects related to invariant theory, homological algebra questions of algebraic geometry, including derived categories and complex analytic, differential geometric, and arithmetic aspects of the geometry of algebraic varieties. Students not meeting course prerequisites or restrictions may seek permission of instructor.

**Prerequisite(s):** MATH 7314 with a minimum grade of C- or MATH 7361 with a minimum grade of C-

**MATH 7321. Topology 3. (4 Hours)**

Continues MATH 7221 and studies classical algebraic topology and its applications. Introduces homotopy theory. Topics include higher homotopy groups, cofibrations, fibrations, homotopy sequences, homotopy groups of Lie groups and homogeneous spaces, Hurewicz theorem, Whitehead theorem, Eilenberg-MacLane spaces, obstruction theory, Postnikov towers, and spectral sequences.

**Prerequisite(s):** MATH 7221 with a minimum grade of C-

**MATH 7335. Discrete Geometry 2. (4 Hours)**

Discusses fundamental concepts in discrete and combinatorial geometry. Topics may include basic convex geometry; convex bodies and polytopes; lattices and quadratic forms; Minkowski's theorem and the geometry of numbers; Blichfeldt's theorem; packing, covering, tiling of spaces; Voronoi diagrams; crystallographic groups and Bieberbach theorems; tilings and aperiodicity; packing and covering densities; Minkowski-Hlawka theorem; sphere packings and codes; polytopes and groups; and other topics at instructor's discretion.

**Prerequisite(s):** MATH 5111 with a minimum grade of C-

**MATH 7338. Probability and Measure. (4 Hours)**

Focuses on measure-theoretic probability theory, with an emphasis on proofs. Introduces measure spaces and the different notions of convergence that are relevant for random variables. Studies the classical limit theorems about sums of independent, identically distributed random variables. Proves both the law of large numbers and central limit theorem under optimal assumptions. Covers the theory of martingales, with applications toward random walks, Markov chains, and continuous time diffusion processes.

**Prerequisite(s):** MATH 5102 with a minimum grade of C-

**MATH 7339. Machine Learning and Statistical Learning Theory 2. (4 Hours)**

Continues MATH 7243. Further covers theory and methods for regression and classification, along with more advanced topics in machine learning, statistical learning, and deep learning. Reviews the basics of machine learning in a broader and deeper way. Additional topics are drawn from smoothing methods, clustering, latent variable models, mixture models, Markov decision process and reinforcement learning, and neural networks. Discusses recent research papers on image classification and segmentation, generative adversarial network, neural style transfer, natural language processing, and topological data analysis. Uses theory, models, and algorithms to analyze a variety of datasets.

**Prerequisite(s):** CS 6140 with a minimum grade of C- or DS 5220 with a minimum grade of C- or EECE 5644 with a minimum grade of C- or MATH 7243 with a minimum grade of C-

**MATH 7340. Statistics for Bioinformatics. (4 Hours)**

Introduces the concepts of probability and statistics used in bioinformatics applications, particularly the analysis of microarray data. Uses statistical computation using the open-source R program. Topics include maximum likelihood; Monte Carlo simulations; false discovery rate adjustment; nonparametric methods, including bootstrap and permutation tests; correlation, regression, ANOVA, and generalized linear models; preprocessing of microarray data and gene filtering; visualization of multivariate data; and machine-learning techniques, such as clustering, principal components analysis, support vector machine, neural networks, and regression tree.

**MATH 7341. Probability 2. (4 Hours)**

Continues MATH 7241. Studies probability theory, with an emphasis on its use in modeling and queueing theory. Starts with basic properties of exponential random variables, and then applies this to the study of the Poisson process. Queueing theory forms the bulk of the course, with analysis of single-server queues, multiserver queues, and networks of queues. Also includes material on continuous-time Markov processes, renewal theory, and Brownian motion.

**Prerequisite(s):** MATH 7241 with a minimum grade of C- or IE 6200 with a minimum grade of C-

**MATH 7342. Mathematical Statistics. (4 Hours)**

Introduces mathematical statistics, emphasizing theory of point estimations. Topics include parametric estimations, minimum variance unbiased estimators, sufficiency and completeness, and Rao-Blackwell theorem; asymptotic (large sample) theory, maximum likelihood estimator (MLE), consistency of MLE, asymptotic theory of MLE, and Cramer-Rao bound; and hypothesis testing, Neyman-Pearson fundamental lemma, and likelihood ratio test.

**MATH 7343. Applied Statistics. (4 Hours)**

Designed as a basic introductory course in statistical methods for graduate students in mathematics as well as various applied sciences. Topics include descriptive statistics, inference for population means, analysis of variance, nonparametric methods, and linear regression. Studies how to use the computer package SPSS, doing statistical analysis and interpreting computer outputs.

**MATH 7344. Regression, ANOVA, and Design. (4 Hours)**

Discusses one-sample and two-sample tests; one-way ANOVA; factorial and nested designs; Cochran's theorem; linear and nonlinear regression analysis and corresponding experimental design; analysis of covariance; and simultaneous confidence intervals.

**MATH 7351. Mathematical Methods of Classical Mechanics. (4 Hours)**

Overviews the mathematical formulation of classical mechanics. Topics include Hamilton's principle and Lagrange's equations; solution of the two-body central force problem; rigid body rotation and Euler's equations; the spinning top; Hamilton's equations; the Poisson bracket; Liouville's theorem; and canonical transformations.

**MATH 7352. Mathematical Methods of Quantum Mechanics. (4 Hours)**

Introduces the basics of quantum mechanics for mathematicians. Introduces the von Neumann's axiomatics of quantum mechanics with measurements in the first part of the course. Discusses the notions of observables and states, as well as the connections between the quantum and the classical mechanics. The second (larger) part is dedicated to some concrete quantum mechanical problems, such as harmonic oscillator, one-dimensional problems of quantum mechanics, radial Schrödinger equation, and the hydrogen atom. The third part deals with more advanced topics, such as perturbation theory, scattering theory, and spin. Knowledge of functional analysis and classical mechanics recommended.

**Prerequisite(s):** (MATH 5102 with a minimum grade of C- or MATH 5102 with a minimum grade of D-); (MATH 5111 with a minimum grade of C- or MATH 5111 with a minimum grade of D-)

**MATH 7359. Elliptic Curves and Modular Forms. (4 Hours)**

Introduces elliptic curves and modular forms. Examines elliptic curves as algebraic varieties over the complex numbers, finite fields, and local and global fields. Related topics include the j-invariant, the Tate module and the Weil pairing, zeta functions and the Weil conjectures, and the Mordell-Weil theorem. Modular forms are defined on moduli spaces of elliptic curves. Related topics include Eisenstein series, cusp forms, congruence subgroups of  $\text{SL}_2(\mathbb{Z})$ , modularity and the Taniyama-Shimura conjecture, and Fermat's Last Theorem.

**Prerequisite(s):** MATH 5111 with a minimum grade of C- or MATH 5112 with a minimum grade of C-

**MATH 7362. Topics in Algebra. (4 Hours)**

Focuses on various advanced topics in algebra, the specific subject matter depending on the interests of the instructor and of the students. Topics may include homological algebra, commutative algebra, representation theory, or combinatorial aspects of commutative algebra. May be repeated without limit.

**MATH 7363. Topics in Algebraic Geometry. (4 Hours)**

Focuses on various advanced topics in algebraic geometry, the specific subject matter depending on the interests of the instructor and of the students. Topics may include integrable systems, cohomology theory of algebraic schemes, study of singularities, geometric invariant theory, and flag varieties and Schubert varieties. May be repeated without limit.

**MATH 7364. Topics in Representation Theory. (4 Hours)**

Offers topics in the representation theory of the classical groups, topics vary according to the interest of the instructor and students. Topics may include root systems, highest weight modules, Verma modules, Weyl character formula, Schur commutator lemma, Schur functors and symmetric functions, and Littlewood-Richardson rule. May be repeated up to five times.

**MATH 7371. Morse Theory. (4 Hours)**

Covers basic Morse theory for nondegenerate smooth functions, and applications to geodesics, Lie groups and symmetric spaces, Bott periodicity, Morse inequalities, and Witten deformation.

**Prerequisite(s):** (MATH 5122 with a minimum grade of C- or MATH 5122 with a minimum grade of D-); MATH 7221 with a minimum grade of C- ; MATH 7301 with a minimum grade of C-

**MATH 7372. Characteristic Classes. (4 Hours)**

Introduces fiber bundles and characteristic classes. Topics include construction of universal bundles, homotopy classification of principal bundles, bundles over spheres, cohomology of classifying spaces, Stiefel-Whitney classes, Gysin and Wang sequences, Thom isomorphism, Euler class, obstructions, Chern classes, Pontrjagin classes, vector fields on spheres, cobordism theory, Hirzebruch index formula, and exotic spheres.

**Prerequisite(s):** MATH 7221 (may be taken concurrently) with a minimum grade of C-

**MATH 7375. Topics in Topology. (4 Hours)**

Offers various advanced topics in algebraic and geometric topology, the subject matter depending on the instructor and the students. Topics may include Morse theory, fiber bundles and characteristic classes, topology of complex hypersurfaces, knot theory and low-dimensional topology, K-theory, and rational homotopy theory. May be repeated without limit.

**Prerequisite(s):** MATH 5121 (may be taken concurrently) with a minimum grade of C-

**MATH 7381. Topics in Combinatorics. (4 Hours)**

Offers various advanced topics in combinatorics, the subject matter depending on the instructor and the students. May be repeated without limit.

**Prerequisite(s):** (MATH 5122 with a minimum grade of C- or MATH 5122 with a minimum grade of D-); MATH 7222 with a minimum grade of C-

**MATH 7721. Readings in Topology. (4 Hours)**

Offers a reading course to be arranged between an individual student and instructor on a topic of their mutual choice. May be repeated without limit.

**MATH 7734. Readings in Algebra. (4 Hours)**

Offers a reading course to be arranged between an individual student and instructor on a topic of their mutual choice. May be repeated without limit.

**MATH 7735. Readings in Algebraic Geometry. (4 Hours)**

Offers a reading course to be arranged between an individual student and instructor on a topic of their mutual choice. May be repeated without limit.

**MATH 7736. Readings in Discrete Geometry. (4 Hours)**

Offers a reading course to be arranged between an individual student and instructor on a topic of their mutual choice. May be repeated without limit.

**MATH 7741. Readings in Probability and Statistics. (4 Hours)**

Offers a reading course to be arranged between an individual student and instructor on a topic of their mutual choice. May be repeated without limit.

**MATH 7755. Readings in Partial Differential Equations. (4 Hours)**

Offers a reading course to be arranged between an individual student and instructor on a topic of their mutual choice. May be repeated up to five times.

**Prerequisite(s):** MATH 7202 with a minimum grade of C-

**MATH 7771. Readings in Geometry. (4 Hours)**

Offers topics in geometry that are beyond the ordinary undergraduate topics. Topics include the regular polytopes in dimensions greater than three, straight-edge and compass constructions in hyperbolic geometry, Penrose tilings, the geometry and algebra of the wallpaper, and three-dimensional Euclidean groups. May be repeated without limit.

**MATH 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MATH 8450. Research Seminar in Mathematics. (4 Hours)**

Introduces graduate students to current research in geometry, topology, mathematical physics, and in other areas of mathematics. Requires permission of instructor for undergraduate mathematics students. May be repeated without limit.

**MATH 8460. Graduate Seminar in Geometry and Representation Theory. (4 Hours)**

Introduces students to topics of fundamental importance for geometry and representation theory by reading foundational papers in these subjects, making presentations, and participating in discussions.

**Prerequisite(s):** MATH 5112 (may be taken concurrently) with a minimum grade of C-

**MATH 8984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**MATH 8986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**MATH 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**MATH 9984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**MATH 9990. Dissertation Term 1. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** MATH 9000 with a minimum grade of S

**MATH 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** MATH 9990 with a minimum grade of S

**MATH 9996. Dissertation Continuation. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** MATH 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Mathematics - CPS (MTH)

### MTH 1100. College Algebra. (3 Hours)

Covers laws of exponents, factoring, inequalities, polynomials, roots, linear and quadratic equations, complex numbers, rational functions, systems of equations, exponential and logarithmic functions, and inverse functions. Requires students to communicate mathematical ideas using symbolic and written forms and to apply algebraic concepts to real-life applications. Seeks to provide students with a solid foundation of concepts and skills necessary to advance to statistics or precalculus. Requires prior knowledge of the manipulation and simplification of basic algebraic expressions.

**Attribute(s):** NUpath Formal/Quant Reasoning

### MTH 1105. Quantitative Skills and Reasoning: Practical Math. (3 Hours)

Uses basic mathematics and statistics concepts to analyze, synthesize, and interpret quantitative data in the context of various disciplines and everyday applications. This is an introductory mathematics course.

### MTH 1200. Precalculus. (3 Hours)

Combines algebraic, geometric, and trigonometric concepts and techniques to model real-world situations (that is, exponential growth and decay, periodic phenomena). Successful completion of this course should strengthen the student's conceptual understanding of mathematics and critical reasoning. Focuses on linear, polynomial, exponential, logarithmic, trigonometric functions and conic sections. Emphasizes understanding, manipulating, and graphing these basic functions, their inverses and compositions, and using them to solve applications drawn from the physical and natural sciences.

**Attribute(s):** NUpath Formal/Quant Reasoning

### MTH 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### MTH 2100. Calculus 1. (3 Hours)

Focuses primarily on differential calculus. Using mathematical models, offers students an opportunity to make predictions and inferences in a variety of applications that relate to the fields of engineering, economics, biology, etc. For example, students can use differential calculus to determine what is the most cost-effective speed to drive a car, using the least amount of fuel. These types of problems, called optimization problems, require an understanding of the derivative as a rate of change. The course focuses on how to apply rules and properties of derivatives to model and solve application problems in science, engineering, and technology. As a prelude to MTH 2105, at the end of the semester, the concept of the integral is introduced as a limit of sums and antiderivatives.

**Attribute(s):** NUpath Formal/Quant Reasoning

### MTH 2105. Calculus 2. (3 Hours)

Continues MTH 2100. Uses mathematical models to make predictions and inferences in a variety of applications that relate to the fields of engineering, economics, biology, etc. Focuses primarily on integral calculus and infinite sequences and series. Topics include definite and indefinite integration, the fundamental theorem of calculus, and the use of integration methods in the calculation of areas and volumes and other applications. Introduces improper integrals as well as the study of infinite sequences and series, power series, Taylor series, and techniques for determining convergence or divergence of sequences series. This course offers an in-depth overview of the above concepts and applies them to solve problems in science, engineering, and technology.

**Prerequisite(s):** MTH 2100 with a minimum grade of D-

**Attribute(s):** NUpath Formal/Quant Reasoning

### MTH 2120. Technical Math 1. (3 Hours)

Reviews topics of trigonometry, differential and integral calculus. Emphasis is placed on limits, continuity, derivatives and integrals of algebraic and transcendental functions of one variable. Upon completion, students should be able to select and use appropriate models and techniques for finding solutions to derivative-related problems with and without technology. This is an accelerated course for designed for Advanced Manufacturing Systems and Engineering Technology students.

**MTH 2220. Technical Math 2. (3 Hours)**

Continuation of MTH 2120. Focuses primarily on integral calculus and differential equations. Topics include definite and indefinite integration, the fundamental theorem of calculus, and the use of integration methods in the calculation of areas and volumes, ordinary differential equations, and Laplace transforms.

**Prerequisite(s):** MTH 2120 (may be taken concurrently) with a minimum grade of D-

**MTH 2300. Business Statistics. (3 Hours)**

Offers students an opportunity to obtain the necessary skills to collect, summarize, analyze, and interpret business-related data. Covers descriptive statistics, sampling and sampling distributions, statistical inference, relationships between variables, formulating and testing hypotheses, and regression analysis in the context of business decision making.

**Prerequisite(s):** MTH 1100 with a minimum grade of D- or MTH 1200 with a minimum grade of D- or MTH 2100 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**MTH 2310. Statistics for the Behavioral and Social Sciences. (3 Hours)**

Offers students an opportunity to obtain the necessary skills to collect, summarize, analyze, and interpret social and behavioral science data. Covers descriptive statistics, sampling and sampling distributions, statistical inference, relationships between variables, formulating and testing hypotheses, and regression analysis in the context of the social and behavioral sciences.

**Prerequisite(s):** MTH 1100 with a minimum grade of D- or MTH 1200 with a minimum grade of D- or MTH 2100 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**MTH 2400. Technology and Applications of Discrete Mathematics. (3 Hours)**

Offers students experience with and exposure to ideas and techniques from discrete mathematics, which is at the foundation of the technological disciplines. Focuses on applications and practical use of discrete mathematics as it is applied to the computing sciences and engineering disciplines. Topics covered include sets; logic; Boolean algebra; machine representations of numbers (decimal, binary, octal, hexadecimal) and arithmetic; counting methods; graphs; and trees. Specific applications include algorithms and complexity, circuits and circuit diagrams, searching and sorting, networks, probability, and finite-state machines. Requires students to select and apply appropriate techniques from discrete math to address common problems found in modern technological systems, especially software and computing hardware design.

**Prerequisite(s):** MTH 1100 with a minimum grade of D- or MTH 1200 with a minimum grade of D- or MTH 2100 with a minimum grade of D-

**Attribute(s):** NUpath Formal/Quant Reasoning

**MTH 2450. Discrete Structures. (3 Hours)**

Covers the necessary foundations from discrete mathematics as widely applied to the computer science and engineering disciplines. Emphasizes appropriate techniques from discrete math to address complex problems found in modern computing science and computer engineering applications.

**Prerequisite(s):** MTH 1100 with a minimum grade of D- or MTH 1200 with a minimum grade of D- or MTH 2100 with a minimum grade of D-

**Attribute(s):** NUpath Formal/Quant Reasoning

**MTH 2500. Statistical Quality Control. (3 Hours)**

Introduces statistical analysis and concepts related to engineering manufacturing quality control, including process capability, control charts, acceptance sampling, and process improvement. Other topics include Six Sigma, statistical and graphical data summaries, quality engineering, and quality design.

**Prerequisite(s):** MTH 2120 with a minimum grade of D-

**MTH 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MTH 3300. Applied Probability and Statistics. (3 Hours)**

Covers randomness, finite probability space, probability measure, events; conditional probability, independence, Bayes' theorem; discrete random variables; binomial and Poisson distributions; concepts of mean and variance; continuous random variables; exponential and normal distribution, probability density functions, calculation of mean and variance; central limit theorem and implications for normal distribution; purpose and the nature of sampling; nature of estimates, point estimates, interval estimates; maximum likelihood, least-squares approach; confidence intervals; estimates for one or two samples; development of models and associated hypotheses; nature of hypothesis formulation, null and alternate hypotheses, testing hypotheses; test statistics: t-test, chi-squared test; correlation and regression; Markov processes, discrete time systems, and continuous time systems; queuing theory, including system simulation and modeling, queuing methods.

**Prerequisite(s):** MTH 2100 with a minimum grade of D- or MTH 2105 with a minimum grade of D- or MTH 2110 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**MTH 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MTH 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**MTH 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Mathematics - CPS Specialty (MATM)****MATM 1120. Precalculus. (4 Hours)**

Focuses on linear, polynomial, exponential, logarithmic, and trigonometric functions. Emphasis is placed on understanding, manipulating, and graphing these basic functions, their inverses and compositions, and using them to model real-world situations (that is, exponential growth and decay, periodic phenomena). Equations involving these functions are solved using appropriate techniques. Special consideration is given to choosing reasonable functions to fit numerical data.

**MATM 1231. Calculus 1 for Business and Economics. (4 Hours)**

Provides an overview of differential calculus including derivatives of power; exponential, logarithmic, logistic functions; and functions built from these. Derivatives are used to model rates of change, to estimate change, to optimize functions, and in marginal analysis. The integral calculus is applied to accumulation functions and future value. Emphasizes realistic business and economics problems, the development of mathematical models from raw business data, and the translation of mathematical results into verbal expression appropriate for the business setting. Also features a semester-long marketing project in which students gather raw data, model it, and use calculus to make business decisions; each student is responsible for a ten-minute presentation.

**MATM 1341. Calculus 1 for Science and Engineering. (4 Hours)**

Covers definition, calculation, and major uses of the derivative, as well as an introduction to integration. Topics include limits; the derivative as a limit; rules for differentiation; and formulas for the derivatives of algebraic, trigonometric, and exponential/logarithmic functions. Also discusses applications of derivatives to motion, density, optimization, linear approximations, and related rates. Topics on integration include the definition of the integral as a limit of sums, antidifferentiation, the fundamental theorem of calculus, and integration by substitution.

**MATM 1342. Calculus 2 for Science and Engineering. (4 Hours)**

Covers further techniques and applications of integration, infinite series, and introduction to vectors. Topics include integration by parts; numerical integration; improper integrals; separable differential equations; and areas, volumes, and work as integrals. Also discusses convergence of sequences and series of numbers, power series representations and approximations, 3D coordinates, parameterizations, vectors and dot products, tangent and normal vectors, velocity, and acceleration in space.

## Mechanical and Industrial Engineering (MEIE)

**MEIE 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MEIE 2949. Introductory Directed Research in Mechanical and Industrial Engineering. (4 Hours)**

Offers an opportunity to pursue project and other independent inquiry opportunities under faculty supervision for first- and second-year students. The course is initiated with a student-developed proposal, including expected learning outcomes and research products, which is approved by a faculty member in the department. Permission of instructor required.

**MEIE 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MEIE 2992. Research. (0 Hours)**

Offers an opportunity to document student contributions to research projects or creative endeavors.

**MEIE 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MEIE 4701. Capstone Design 1. (1 Hour)**

Offers the first in a two-course sequence that culminates the student's education and experience with the design process. Students form teams and are assigned their design project and faculty adviser. Projects can be industrially, departmentally, or externally sponsored. Students are expected to communicate with their faculty adviser, course coordinator, and sponsor using the Internet, teleconferencing, and other electronic methods. Topics include project management, ethics, cost analysis, Internet and library research methods, and engineering codes and standards. Students prepare written reports and make oral presentations. Students are expected to complete a thorough state-of-the-art report on their problem and a problem statement with specifications and requirements.

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov, NUpath Writing Intensive

**MEIE 4702. Capstone Design 2. (5 Hours)**

Continues MEIE 4701. Students are expected to apply engineering principles acquired throughout their undergraduate academic and co-op experiences to the design of a system, component, or process. Each project includes the development and use of design methodology, formulation of design problem statements and specifications, consideration of alternative solutions, feasibility considerations, and detailed system descriptions. Projects include realistic constraints such as economic factors, safety, reliability, maintenance, aesthetics, ethics, and political and social impact. Students make oral presentations on their results in a series of design reviews. Students document their solutions using a written report that includes an executive summary. A working prototype or simulation, as appropriate, of their solution is required to complete the course.

**Prerequisite(s):** MEIE 4701 with a minimum grade of D- ; ((ME 4550 with a minimum grade of D- or ME 4570 with a minimum grade of D- ) or (IE 4510 with a minimum grade of D- ; IE 4515 with a minimum grade of D- ; IE 4516 with a minimum grade of D- ; IE 4530 (may be taken concurrently) with a minimum grade of D- ))

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov, NUpath Writing Intensive

**MEIE 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MEIE 6800. Technical Writing and Professional Development. (0 Hours)**

Offers students an opportunity to increase their professional communication skills through intensive verbal practice and technical writing application. Students work together in groups and individually to practice verbal and written communication that can increase their English competency and comfort level for work in the United States. This course does not count toward graduation requirements.

**MEIE 6830. Graduate Traineeship 1, Technical Writing and Communications. (2 Hours)**

Focuses on technical writing. Covers writing and preparation tips for technical papers. Includes effective communications, such as Ph.D. proposal preparation and presentation, and technical seminar presentation tips.

**MEIE 6850. Research Seminar in Mechanical and Industrial Engineering. (0 Hours)**

Offers a research seminar presenting topics of current interest in a variety of areas in mechanical and industrial engineering. May be repeated without limit.

**MEIE 6860. Graduate Traineeship 2, Research Ethics and Professional Development. (2 Hours)**

Focuses on responsible conduct of research, research misconduct (plagiarism, falsification, and fabrication), research ethics, and professional and personal development. Offers optional modules on grant proposal preparation, academic career preparation, faculty and professional jobs search, research and teaching statements preparation, how to become an effective teacher, mentorship, entrepreneurship, and industry insights and real-world experiences.

**MEIE 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Mechanical Engineering (ME)****ME 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ME 2340. Introduction to Material Science. (4 Hours)**

Introduces the materials science field, which emphasizes the structure-processing property-performance relationships for various classes of materials including metals, ceramics, polymers, electronic materials, and magnetic materials. Topics include crystallography, structure of solids, imperfections in crystals, mechanical properties, dislocation theory, slip, strengthening mechanisms, phase equilibrium, phase transformations, diffusion, thermal and optical physical properties, and electrical and magnetic properties. Issues associated with materials selection, including economic and environmental consequences of materials choices, are also addressed. Laboratory experiments, with written memo and report submissions, are required. Includes individual and team-based projects.

**Prerequisite(s):** (CHEM 1151 with a minimum grade of D- or CHEM 1161 with a minimum grade of D- or CHEM 1211 with a minimum grade of D- ); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Corequisite(s):** ME 2341

**Attribute(s):** NUpath Writing Intensive

**ME 2341. Lab for ME 2340. (1 Hour)**

Accompanies ME 2340. Covers topics from the course through various activities.

**Corequisite(s):** ME 2340

**ME 2350. Statics. (4 Hours)**

Introduces the vector representation of force and moment, the equivalent force systems, free body diagrams, and equations of equilibrium. Discusses centroids and center of gravity of rigid bodies. Examines applications to beams, trusses, and pin-connected frames and elementary concepts of friction. Discusses variation of internal forces and moments for beams and cable systems. Theory of dry friction is implemented in simple machine elements. Introduces the concepts of virtual work and potential energy. Includes a design project that demonstrates the fundamental concepts of equilibrium.

**Prerequisite(s):** (PHYS 1151 with a minimum grade of D- or PHYS 1161 with a minimum grade of D- or PHYS 1171 with a minimum grade of D- ); MATH 1342 with a minimum grade of D-

**ME 2355. Mechanics of Materials. (4 Hours)**

Discusses concepts of stress and strain; transformation of stress and strain at a point; stress-strain relations material properties; second moments of cross-sectional areas; stresses and deformations in simple structural members due to axial torsional, and flexural loading for statically determinate and indeterminate cases; design of beams under combined loading; and stability of structures and buckling of columns with various supports. Laboratory experiments and written reports are required.

**Prerequisite(s):** ME 2350 with a minimum grade of D- or CIVE 2221 with a minimum grade of D-

**Corequisite(s):** ME 2356

**ME 2356. Lab for ME 2355. (1 Hour)**

Accompanies ME 2355. Covers topics from the course through various activities.

**Corequisite(s):** ME 2355

**ME 2380. Thermodynamics. (4 Hours)**

Defines and calculates thermodynamic properties such as energy, entropy, temperature, and pressure. Work and heat interactions are defined. The first and second laws of thermodynamics and concepts of thermodynamic equilibrium are introduced. Conservation of energy and mass and the entropy balance relation are discussed for open and closed systems. Irreversibility, energy, and the energy balance relation are introduced and applied in analyzing thermodynamic systems. Fundamentals of thermodynamics are used to model power generation and refrigeration systems. Covers thermodynamics of nonreacting gas mixtures with applications to air-water vapor mixtures for air-conditioning systems.

**Prerequisite(s):** MATH 2321 with a minimum grade of D- ; (PHYS 1151 with a minimum grade of D- or PHYS 1161 with a minimum grade of D- )

**Corequisite(s):** ME 2381

**ME 2381. Recitation for ME 2380. (0 Hours)**

Accompanies ME 2380. Offers demonstrations and opportunities for problem solving.

**Corequisite(s):** ME 2380

**ME 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ME 3455. Dynamics. (4 Hours)**

Treats the kinematics and kinetics of particles by using force, mass and acceleration, and energy and momentum methods. Investigates kinematics of rigid bodies in general plane motion. Introduces mass moment of inertia; kinetics of rigid bodies by using force-mass-acceleration, work and energy, and impulse and momentum methods; and free and forced vibration of undamped and damped one-degree-of-freedom systems.

**Prerequisite(s):** (ME 2350 with a minimum grade of D- or CIVE 2221 with a minimum grade of D- ); MATH 2341 with a minimum grade of D-

**Corequisite(s):** ME 3456

**ME 3456. Lab for ME 3455. (1 Hour)**

Accompanies ME 3455. Covers topics from the course through various activities.

**Corequisite(s):** ME 3455

**ME 3460. Robot Dynamics and Control. (4 Hours)**

Covers fundamental components and mechanisms of robotic systems and their multidisciplinary nature. Introduces the robot's kinematics, dynamics, and control. Presents a quick overview of forward and inverse kinematics, robot dynamics, as well as path planning and control techniques. Topics also include dynamic modeling and analysis of mechanically, electrically, and magnetically driven hydraulic and pneumatic drives; kinematics and motion analysis of linkages; as well as sensing technologies (e.g., position, linear and angular displacements, velocity and acceleration, force and torque sensors) used in robotic systems. Presents kinematics and control of automatic machinery and manufacturing processes, automatic assembly, and inspection robotic systems as representative examples.

**Prerequisite(s):** CS 3650 with a minimum grade of D- or MATH 2331 with a minimum grade of D- or MATH 2341 with a minimum grade of D-

**ME 3465. Introduction to Flight. (4 Hours)**

Presents the fundamentals of aerospace engineering at the introductory level. Covers historical developments and background associated with aerospace engineering in parallel with technical discussions. Introduces thermodynamic analyses of flowing gasses and derivations of the governing equations accompanying the anatomy of airplanes and space vehicles. Studies basics of fluid dynamics such as continuity, momentum and energy equations, and isentropic flows. Discusses shapes, designs, characteristics, and usage of different aerodynamic shapes and their corresponding lift, drag, and momentum coefficients. Explores the elements of airplane performance in level flight, takeoff, and landing. Covers the introduction to the dynamics of flight, stability, and control of the airplanes and astronautic vehicles. Designed for students interested in an introductory course in aerospace engineering and the fundamentals and historical traditions of aerodynamics of flight.

**Prerequisite(s):** MATH 2321 with a minimum grade of D- ; (PHYS 1151 with a minimum grade of D- or PHYS 1161 with a minimum grade of D- );

ME 2380 with a minimum grade of D-

**ME 3470. Aeronautical Propulsion. (4 Hours)**

Introduces basics for the analysis and design of aircraft engines and reviews the history of gas turbine engines. Introduces general conservation laws of mass, energy, and momentum for compressible flows and application to quasi-one-dimensional internal flows and shock waves in external flows. Reviews thrust and thermodynamic performance of the engines. Discusses designing parameters of the inlets in detail. Uses the principles of chemical equilibrium to calculate the composition of combustion products in a chemical reaction to find flame temperature and energy release, which drive the design of combustors and afterburners. Introduces physics and aerodynamics of compressors and turbines, and reviews basics of gas turbine blades cooling.

**Prerequisite(s):** ME 2380 with a minimum grade of D-

**ME 3475. Fluid Mechanics. (4 Hours)**

Studies fundamental principles in fluid mechanics. Topics include hydrostatics (pressure distribution, forces on submerged surfaces and buoyancy); Newton's law of viscosity; dimensional analysis; integral forms of basic laws (conservation of mass, momentum, and energy); pipe flow analysis; differential formulation of basic laws including Navier-Stokes equations; and the concept of boundary layer and drag coefficient. Includes a team-based independent project.

**Prerequisite(s):** MATH 2321 with a minimum grade of D- ; ME 2380 with a minimum grade of D-

**ME 3480. International Applications of Fluid Mechanics. (4 Hours)**

Studies fundamental principles in fluid mechanics in an international setting. Students have an opportunity to travel to a foreign locale to develop theoretical understanding while experiencing the issues that affect applications of fluids engineering in a culture and environment different from their own. Topics include hydrostatics (pressure distribution, forces on submerged surfaces, and buoyancy); Newton's law of viscosity; dimensional analysis; integral forms of basic laws (conservation of mass, momentum, and energy); pipe flow analysis; differential formulation of basic laws including Navier-Stokes equations; and the concept of boundary layer and drag coefficient. Includes a team-based independent project that focuses on applications that allow students to delve into issues that affect engineering and technology development in their host country.

**Prerequisite(s):** MATH 2321 with a minimum grade of D- ; ME 2380 with a minimum grade of D-

**ME 3500. Materials Selection for Mechanical Engineers. (4 Hours)**

Covers systematic strategies for selecting materials for mechanical designs considering properties, shape, and other design requirements. Examines how to choose materials when there are multiple constraints and conflicting objectives and how to use materials indices for material selection. A term project requires students to choose a project of interest, select materials for it, and present the rationale for their selections to the class. Introduces industrially relevant materials selection software as a tool for systematic materials selection in various case studies.

**Prerequisite(s):** ME 2340 with a minimum grade of D

**ME 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ME 4505. Measurement and Analysis with Thermal Science Application. (4 Hours)**

Introduces basic measurements and data analysis techniques. Offers students an opportunity to become familiar with various types of measurement systems and to set up and perform experiments according to a given procedure. Covers basic measurement methods of rotational frequency; temperature, pressure, and power; and analog-to-digital conversion techniques and data acquisition. Data analysis topics include statistical analysis of data, probability and inherent uncertainty, basic measurement techniques, primary and secondary standards, system response characteristics, and computerized data acquisition methods. Includes experiments in thermodynamics, fluid mechanics, and heat transfer. Topics include cycle performance, flow discharge coefficient and heat transfer coefficient measurements, and psychometric applications in the air-conditioning field.

**Prerequisite(s):** ME 2380 with a minimum grade of D-

**Corequisite(s):** ME 4506

**Attribute(s):** NUpath Analyzing/Using Data

**ME 4506. Lab for ME 4505. (1 Hour)**

Accompanies ME 4505. Covers topics from the course through various activities.

**Corequisite(s):** ME 4505

**ME 4508. Mechanical Engineering Computation and Design. (4 Hours)**

Highlights the role of finite element analysis in product development. Introduces the theory of finite elements in elastic/plastic, static, and transient problems. Emphasis is on solid modeling in design using available commercial finite element software. Also covers other numerical techniques such as finite difference schemes in the solution of systems of partial differential equations, and numerical solution to systems of linear and nonlinear equations.

**Prerequisite(s):** (ME 2355 with a minimum grade of D- ; MATH 2341 with a minimum grade of D- ) or (BIOE 2350 with a minimum grade of D- ; (GE 2361 with a minimum grade of D- or MATH 2341 with a minimum grade of D- ))

**ME 4520. Mechanical Vibration. (4 Hours)**

Covers concepts in mechanical vibration analysis. Topics include basic concepts of vibrations, vibration problems vs. dynamic problems, linear vs. nonlinear vibrations, vibrational elements, harmonic motion; free vibration of undamped SDOF systems, stability, Rayleigh's energy method, free vibration of viscously damped SDOF systems, free vibration of damped SDOF systems with Coulomb and hysteretic damping; harmonically forced SDOF systems, harmonic motion of base and rotating unbalance, forced vibrations of Coulomb-damped and hysteresis-damped SDOF systems, general (nonperiodically) forced vibrations; free and forced vibrations of 2 DOF systems, damped vibrations, general eigenvalue problem, vibration measuring instruments; tuned vibration absorbers, passive and active vibration absorbers, vibration-control systems (passive, semiactive, and active), modal analysis software, and illustrative examples.

**Prerequisite(s):** MATH 2341 (may be taken concurrently) with a minimum grade of D- ; ME 3455 (may be taken concurrently) with a minimum grade of D-

**ME 4550. Mechanical Engineering Design. (4 Hours)**

Explores development of the mechanical design process and its open-ended nature. Reviews fundamentals of stress and theories of failure including fatigue considerations in the analysis of various machine components. Treatment is given to shafts, springs, screws, connections, lubrications, bearings, gears, and tolerances. Includes team-based design projects that involve modeling and the design process.

**Prerequisite(s):** ME 2355 with a minimum grade of D-

**ME 4555. System Analysis and Control. (4 Hours)**

Presents the theoretical backgrounds for the analysis and design of simple feedback control systems, differential equations, and Laplace transforms. Treats system modeling, linear approximations, transfer functions, and block diagrams; and transient and frequency response and stability-frequency domain and root locus methods. Other topics may include linear systems with time lag and relay servomechanisms with small nonlinearities.

**Prerequisite(s):** ME 3455 with a minimum grade of D- or (BIOE 2350 with a minimum grade of D- ; BIOE 3380 with a minimum grade of D- )

**ME 4565. Introduction to Computational Fluid Dynamics. (4 Hours)**

Introduces numerical methods applied to solve fluid flow problems. Includes basic mathematics and physics related to computational fluid dynamics (CFD), together with practical assignments that use commercial CFD packages. Emphasizes finite difference and finite volume methods. Other topics include mathematical properties of partial differential equations, accuracy and stability analysis of numerical solution, CFD verification and validation, application to variety of fluid dynamics problems, grid generation, and turbulence modeling.

**Prerequisite(s):** (ME 3475 with a minimum grade of D- or ME 3480 with a minimum grade of D- or BIOE 3310 with a minimum grade of D- ); (MATH 2341 with a minimum grade of D- or GE 2361 with a minimum grade of D- )

**ME 4570. Thermal Systems Analysis and Design. (4 Hours)**

Introduces theories of thermal energy transport, including conduction, convection, and thermal radiation, and the design of thermal systems. Solution methods are developed for steady-state and transient conduction problems including thermal circuit analogies, internal energy sources and extended surfaces. Convective heat transfer mechanisms are introduced and correlations to evaluate the heat transfer coefficient are discussed. Methodologies for calculating the thermal radiation heat transfer between surfaces are introduced. These theories are integrated with thermodynamics and fluid mechanics in the design of thermal systems, including heat exchangers. Includes an open-ended design project and students are expected to use computational methods throughout the course.

**Prerequisite(s):** ME 2380 with a minimum grade of D- ; (ME 3475 with a minimum grade of D- or ME 3480 with a minimum grade of D- )

**ME 4670. Internal Combustion Engine. (4 Hours)**

Presents the concepts and theories of operation of internal combustion engines based upon the fundamental engineering sciences of thermodynamics, gas dynamics, heat transfer, and mechanics. Discusses the design and operating characteristics of conventional spark-ignition, compression-ignition, Wankel, and stratified charge. Explores the relationship between vehicle load and engine load through differential and transmission gear-ratio selections. Includes laboratory experiments.

**Prerequisite(s):** ME 2380 with a minimum grade of D- ; (ME 3475 with a minimum grade of D- or ME 3480 with a minimum grade of D- )

**ME 4699. Special Topics in Mechanical Engineering. (4 Hours)**

Focuses on an advanced mechanical engineering project agreed upon between the student and instructor. May be repeated without limit.

**ME 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**ME 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** ME 4970 with a minimum grade of D-

**ME 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ME 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated once.

**Attribute(s):** NUpath Integration Experience

**ME 4992. Directed Study. (1-4 Hours)**

Offers theoretical or experimental work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**ME 5240. Computer Aided Design and Manufacturing. (4 Hours)**

Covers basic aspects of computer graphics and CAD/CAM. Topics include hardware and software concepts, generic structure of CAD/CAM software and its modules, and CAD/CAM database structure. Also covers the parametric representations of curves, surfaces, solids, and features that are widely used in existing commercial CAD/CAM systems. Discusses geometrical transformations, CAD/CAM data exchange formats, prototyping techniques, and PDM. Presents applications such as mass properties calculations, assemblies, mechanical tolerancing, simulation, finite element mesh generation, process planning and CAPP, CNC part programming, and Web-based CAD/CAM.

**Prerequisite(s):** GE 1110 with a minimum grade of B or GE 1501 with a minimum grade of B or graduate program admission

**ME 5245. Mechatronic Systems. (4 Hours)**

Covers integration of electronic/electrical engineering, computer technology, and control engineering with mechanical engineering to provide a self-contained, modern treatment of mixed systems along with their computer simulation and applications. Topics include mixed-systems integration; sensors, actuation systems; brief overview of dynamic systems modeling, response characterization, and closed-loop controllers; interfacing; data presentation systems and processes; microprocessors; real-time monitoring and control; and applications of mechatronic systems. The course also offers numerous MATLAB/Simulink examples of select mechatronic systems and devices along with open-ended design projects and assignments.

**Prerequisite(s):** ME 4555 with a minimum grade of C or ME 5659 with a minimum grade of C or ME 5659 with a minimum grade of C

**ME 5250. Robot Mechanics and Control. (4 Hours)**

Covers kinematics and dynamics of robot manipulators, including the development of kinematics equations of manipulators, the inverse kinematics problem, and motion trajectories. Employs Lagrangian mechanics to cover dynamics of manipulators for the purpose of control. Covers control and programming of robots, steady state errors, calculations of servoparameters, robot vision systems and algorithms, as well as imaging techniques and the concept of mobile robots.

**Prerequisite(s):** ME 4555 with a minimum grade of D- or graduate program admission

**ME 5374. Special Topics in Mechanical Engineering. (4 Hours)**

Offers topics of current interest in mechanical engineering.

**ME 5510. Scientific Machine Learning for Mechanical Engineers. (4 Hours)**

Explores the application of machine learning, particularly deep learning, in advancing the scientific principles for engineering complex systems, a field known as Scientific Machine Learning, or SciML. Discusses methodologies for addressing challenges in computational mechanics, mechanical design, and fluid dynamics. Examines approaches to create domain-aware, interpretable, and robust SciML algorithms to overcome the limitations of purely data-driven methods.

**ME 5520. Fundamentals and Applications of Optics and Photonics. (4 Hours)**

Introduces the basic knowledge and recent development in the field of optics and photonics. Explains the property of light from four perspectives: geometric optics, wave optics, electromagnetic optics based on Maxwell's equations, as well as quantum mechanics. Discusses the interactions between light and materials, ranging from bulk to nano and molecular level. Presents representative applications, particularly in the domain of mechanical engineering, which include imaging and microscopy, photolithography, 3D laser printing, solar desalination, radiative cooling, optical tweezers to manipulate micro/nano objects, and solar sails for spacecraft propulsion.

**Prerequisite(s):** (PHYS 1155 with a minimum grade of D or PHYS 1165 with a minimum grade of D ) or graduate program admission

**ME 5554. Robotics Sensing and Navigation. (4 Hours)**

Examines the actual sensors and mathematical techniques for robotic sensing and navigation with a focus on sensors such as cameras, sonars, and laser scanners. These are used in association with techniques and algorithms for dead reckoning and visual inertial odometry in conjunction with GPS and inertial measurement units. Covers Kalman filters and particle filters as applied to the SLAM problem. A large component of the class involves programming in both the ROS and LCM environments with real field robotics sensor data sets. Labs incorporate real field sensors and platforms. Culminates with both an individual design project and a team-based final project of considerable complexity.

**Prerequisite(s):** ((MATH 3081 with a minimum grade of D- or EECE 3468 with a minimum grade of D- ); (EECE 2160 with a minimum grade of D- or EECE 2210 with a minimum grade of D- )) or graduate program admission

**ME 5600. Materials Processing and Process Selection. (4 Hours)**

Covers the fundamentals and usage of processes and techniques for bulk, thick film, thin film, and patterned structures. Covers techniques for improvement of mechanical or functional properties, for reliability, or for operation in harsh environments. Includes case studies for which processes are selected based on efficacy, material input, and cost. Systems studied include biocompatible implants and materials for the telecommunication, semiconductor, energy, and aerospace industries.

**ME 5620. Fundamentals of Advanced Materials. (4 Hours)**

Offers a deep dive into the interdisciplinary field of materials science that addresses the discovery, design, and prediction of new materials, with an emphasis on solids. Offers students an opportunity to gain knowledge and practice in issues of materials science. Consists of fundamentals, properties (emphasis on electronic properties), applications, and advanced topics. Provides specific readings from the literature assigned to support the in-class lectures. Offers a variety of opportunities to practice and demonstrate comprehension and learning.

**Prerequisite(s):** ME 2340 with a minimum grade of D- or graduate program admission

**ME 5630. Nano- and Microscale Manufacturing. (4 Hours)**

Introduces students to nano- and microscale manufacturing of applications in electronics, energy, materials, and life sciences. Offers students an opportunity to understand conventional fabrication approaches to making today's consumer electronics (top-down). Presents new and emerging bottom-up manufacturing approaches, including additive manufacturing for making electronics and other applications.

**ME 5640. Additive Manufacturing. (4 Hours)**

Discusses fundamentals, process characteristics, and practical applications of various additive manufacturing (AM) processes. Covers digital workflow for AM, implications of AM on design, material for AM and material properties, energy sources and interaction with materials, AM processes, process characteristics and capabilities, process models, design of experiments and Taguchi methods for AM process parameter optimization, postprocessing of AM parts, process defects, and the Ansys AM module.

**ME 5650. Advanced Mechanics of Materials. (4 Hours)**

Covers stress, strain, and deformation analysis of simple structures including beams, plates, and shells. Topics include classical theory of circular and rectangular plates; combined effects of bending and in-plane forces; buckling of plates; effects of shear deformation and of large deflections; membrane theory of shells; analysis of cylindrical shells; introduction to energy methods with applications to beams, frames, and rings; Ritz method; and the concept of stability as applied to one and two degree-of-freedom systems buckling of bars, frames, and rings. Permission of instructor required for undergraduate students.

**ME 5653. Inelasticity. (4 Hours)**

Introduces models suitable for rate-independent and rate-dependent plasticity, creep, viscoplasticity, viscoelasticity, and damage. Emphasizes the interdisciplinary nature of nonlinear constitutive theories. Offers students an opportunity to understand the phenomenological aspects of nonlinear and time-dependent material behavior and to obtain the ability to develop and use mathematical models that describe inelastic deformation behavior.

**Prerequisite(s):** ME 2355 with a minimum grade of D- or graduate program admission

**ME 5654. Elasticity and Plasticity. (4 Hours)**

Covers stress and strain analysis in continuous media. Analyzes Cartesian tensors using indicial notation; stress and strain concepts; point stress and strain; relation to tensor concepts; equations of equilibrium and compatibility; constitutive laws for elastic, general, axisymmetric, plane stress, and plane strain formulations and solutions; the relation of elasticity to structural mechanics theories; physical basis of plastic/inelastic deformation of solids; and constitutive descriptions of plasticity including yielding, hardening rules, Prandtl-Reuss constitutive laws, and viscoplasticity.

**Prerequisite(s):** ME 4550 with a minimum grade of B- or graduate program admission

**ME 5655. Dynamics and Mechanical Vibration. (4 Hours)**

Covers dynamic response of discrete and continuous media. Topics include work and energy, impulse and momentum, Lagrangian dynamics, free and forced response to periodic and transient excitations, vibration absorber, free and forced response of multiple degree-of-freedom systems with and without damping, method of modal analysis, vibrations of continuous media such as extensional, torsional, and bending vibrations of bars, and approximate methods of analysis. Permission of instructor required for undergraduate students.

**ME 5657. Finite Element Method 1. (4 Hours)**

Focuses on numerical techniques for solving engineering problems. Topics include introduction to the finite element method; methods of approximations and variational methods; Rayleigh-Ritz method and Galerkin formulation; interpolation functions; truss, beam, plate, shell, and solid elements; stiffness matrix and assembly of element equations; application of finite element method in fluid and heat transfer problems; linear, nonlinear, and transient problems; numerical integration and methods of solving systems of equations for static and dynamic problems; and use of a finite element general-purpose commercial package. Permission of instructor required for undergraduate students.

**ME 5658. Continuum Mechanics. (4 Hours)**

Covers the stresses, strains, and displacements in general continuous media. Topics include vector and tensor calculus; definitions of stress, strain, and deformation; kinematics of a continuous medium; material derivatives; rate of deformation tensor, finite strain, and deformation; Eulerian and Lagrangian formulations; geometric measures of strain; relative deformation gradient, rotation, and stretch tensors; compatibility conditions; general principles; conservation of mass; momentum principles; energy balance; constitutive theories of materials (i.e., heat conduction, fluid mechanics, elastic solids, nonlinear elasticity, inelastic deformation of solids); variational principles; introduction to the nonlinear finite element formulations for solids, such as nonlinearities in solid mechanics, governing equations (strong form and weak form), finite element approximation, Newton-Raphson method, Lagrangian finite elements (total and updated Lagrangian approaches), and solution procedure.

**Prerequisite(s):** ME 4550 with a minimum grade of B- or graduate program admission

**ME 5659. Control Systems Engineering. (4 Hours)**

Covers concepts in design and control of dynamical systems. Topics include review of continuous-time system modeling and dynamic response; principles of feedback, classical and modern control analyses, and design techniques such as root locus, frequency response (e.g., Bode plots and Nyquist Criteria), and state-space feedback; dynamic analysis, design, and control of electromechanical systems; block diagram algebra or signal-flow graphs, effects of poles and zeros on system response characteristics; principles of controllability, observability, observer designs, and pole placement techniques; introduction to adaptive and learning control and digital implementation of control algorithms.

**ME 5661. Composite Materials. (4 Hours)**

Discusses the structure, composition, deformation, and failure analysis of composite materials. Topics include introduction to composite materials, constitutive relations and mechanical properties of particulate reinforced composites, anisotropic lamina and cellular composites, and micromechanical models of laminated composites; mechanical behaviors and properties of cellular composites and sandwich composites; and their design, manufacturing, computational modeling, and mechanical experimental characterizations.

**ME 5665. Musculoskeletal Biomechanics. (4 Hours)**

Using a three-part format, emphasizes the quantitative analysis of human musculoskeletal system statics and dynamics, including, in part I, gait analysis and estimation of the complex loads on human joint systems. Investigates how the form of connective tissue and bone is derived from function in part II, including a quantitative analysis of the material properties of bone, ligament, tendon, and cartilage. Working in groups in part III, students select and investigate a relevant, current topic in musculoskeletal biomechanics and present their findings to the class. Requires prior completion of an undergraduate course in biomechanics (Northeastern's BIOE 2350 or equivalent). Permission of instructor required for undergraduate students.

**ME 5680. Applications of Concentrating Solar Thermal Technologies. (4 Hours)**

Focuses on the analysis of concentrating solar thermal technologies at the design and system levels. Discusses simulation techniques to calculate the performance of concentrating solar power (CSP) technologies, including comparisons to other solar systems in terms of efficiency and cost. Includes topics involving solar systems designs of heliostats, concentrating dishes, and troughs. Presents geometric optics and convolution techniques and integrates them with incident solar predictions to calculate the performance of CSP systems. Covers the control and tracking systems required to maximize performance; the thermal effects that occur at the high solar energy fluxes and high temperatures in CSP systems; and the potential advantages in energy generation, energy storage, and biogas manufacturing and means to predict them.

**Prerequisite(s):** ME 4570 with a minimum grade of C or graduate program admission

**ME 5685. Solar Thermal Engineering. (4 Hours)**

Develops a model for the hourly direct and diffuse radiation under a cover of scattered clouds and the transmission and absorption of this radiation by passive and active systems. Considers the design of air heating systems and the storage of the collected energy by a pebble bed, and considers elements of heater exchanger design. Makes a study of the economics of a domestic water and/or space heating system using f-chart analysis. Requires prior completion of ME 4570 or equivalent.

**ME 5690. Gas Turbine Combustion. (4 Hours)**

Offers students an opportunity to obtain an understanding of the basic physical, chemical, and aerodynamic processes associated with combustion in gas turbine engines and their relevance to combustor design and performance in applications ranging from aeronautical to power generation. Topics include the history and evolution of gas turbine engines, thermodynamic cycles, conventional and alternative aviation fuels, combustion fundamentals, fuel injection and atomization, advanced wall cooling techniques, mechanisms of combustion noise and approaches to noise control, and design and performance for ultra-low emissions.

**Prerequisite(s):** ME 4570 with a minimum grade of D- or graduate program admission

**ME 5695. Aerodynamics. (4 Hours)**

Focuses on topics of practical importance in applications of fluid mechanics to external flows over bodies. Covers compressible flow analysis in order to use the concepts of sound speed and Mach number and to design subsonic and supersonic nozzles, diffusers, and airfoils. Introduces normal and oblique shock waves and the Prandtl-Meyer expansion applied to supersonic flows over bodies and surfaces. Discusses Rayleigh and Fanno flows. Studies and applies the Bernoulli equation and potential flow theory to external flow analyses and the theory of lift generation on airfoils.

**ME 5700. Multiphase Transport. (4 Hours)**

Introduces multiphase flow and heat transfer. Presents insights of multiphase transport systems, tools to analyze the system in different scenarios, and exposes students to research frontiers and real-world applications. Topics include the fundamental principles governing the multiphase systems, capillary effect involving drops and bubbles, the dynamics of particles dispersed in fluid, phase change and heat transfer, and applications of multiphase systems. Discusses research topics at the frontier in this area.

**Prerequisite(s):** (ME 4570 with a minimum grade of D or CHME 3312 with a minimum grade of D ) or graduate program admission

**ME 5976. Directed Study. (1-4 Hours)**

Offers students an opportunity to conduct theoretical or experimental work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated up to 11 times for a maximum of 12 semester hours.

**ME 5984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**ME 6200. Mathematical Methods for Mechanical Engineers 1. (4 Hours)**

Focuses on linear algebra, vector analysis, ordinary, and partial differential equations with mechanical engineering applications. Topics include linear algebra, linear vector spaces, matrices, and eigenvectors; vector field theory, curvilinear coordinates, and integral theorems; power series methods for second order linear ODEs, special functions, Sturm-Liouville theory, and orthogonal function expansions including Fourier series; second order linear PDEs including the Laplace, diffusion, and wave equations and solution techniques such as separation of variables and orthogonal function decomposition.

**ME 6202. Numerical Methods. (4 Hours)**

Covers numerical techniques in linear algebra, the numerical solution of ordinary differential equations, and optimization of continuous functions. Introduces coding and algorithm performance analysis in contexts such as mechanics, materials science, and data science. Offers students an opportunity to obtain tools for tackling computational challenges in engineering and scientific research.

**ME 6250. Wearable Robotics. (4 Hours)**

Presents the design, control, and evaluation of prosthetics and exoskeletons based on core concepts in human movement, with special focus on assisting and rehabilitating pathological gait. Introduces the biological systems that enable human movement, biomechanical modeling and simulation, actuation design, control architectures, and key considerations for interfacing mechanical systems with the human body. Culminates with group projects in which teams either design, control, and analyze a wearable robotic system or write a perspective on a subtopic within the field of wearable robotics.

**ME 6260. Introduction to Microelectromechanical Systems (MEMS). (4 Hours)**

Provides an introduction to microelectromechanical systems including principles of sensing and actuation, microfabrication technology for MEMS, noise concepts, and packaging techniques. Covers a wide range of disciplines, from electronics to mechanics, material properties, microfabrication technology, electromagnetics, and optics. Studies several classes of devices including inertial measurement devices, pressure sensors, rf components, and optical MEMS. Devotes the last third of the semester largely to design projects, involving design of MEMS devices to specifications in a realistic fabrication process.

**ME 6320. Mechanics of Soft Materials. (4 Hours)**

Covers the fundamental continuum mechanics theory of finite elastic deformation in soft materials formed by crosslinked polymer networks such as gels and elastomers, as well as the coupling effects from other physical fields (chemical, electrical, thermal, etc.) that enable novel functionalities. Emphasizes continuum mechanics, interfacing statistical mechanics, polymer physics, thermodynamics, and other chemical and physical disciplines. Lectures incorporate state-of-the-art research in mechanics of soft materials to offer students a broad and contemporary overview of the field.

**Prerequisite(s):** ME 6200 with a minimum grade of B

**ME 6340. Mechanics in New Engineering Frontiers. (4 Hours)**

Offered for graduate students who are interested in mechanics in emerging engineering frontiers including mechanical metamaterials, bio-inspired engineering, additive manufacturing, and smart and functional materials. Provides an overview of the new interdisciplinary fields and the application of mechanics in these fields. Also examines advanced theories in mechanics and their applications in new engineering frontiers. Mechanics together with modern engineering technologies including computer aided design, computer simulations, and 3D/4D printing serve as tools to explore engineering solutions. Students practice how to apply physical principles to engineering innovations.

**Prerequisite(s):** (ME 5650 with a minimum grade of B or ME 5654 with a minimum grade of B or ME 7210 with a minimum grade of B); ME 6200 with a minimum grade of B

**ME 6360. Boundary Value Problems in Linear Elasticity. (4 Hours)**

Introduces the governing equations of linear isotropic elasticity and solves the boundary value problems associated with two-dimensional (planar) and three-dimensional elasticity. In two-dimensional elasticity, presents the use of Airy stress function in Cartesian and polar coordinates; asymptotic fields at discontinuities; forces and dislocations; contact and crack problems; and rotating and accelerating bodies. In three-dimensional elasticity, presents Galerkin and Papkovich-Neuber solutions; singular solutions; spherical harmonics; thermoelasticity; axisymmetric contact and crack problems; and axisymmetric torsion.

**Prerequisite(s):** ME 6200 with a minimum grade of B ; (ME 5650 with a minimum grade of B or ME 5654 with a minimum grade of B )

**ME 6420. Advanced Materials and Technologies in Manufacturing. (4 Hours)**

Provides integrated coverage of how material properties influence process selection, how processes enable new designs, and how sustainable processes can be developed. Offers practical knowledge of contemporary manufacturing techniques along with skills to evaluate interactions between materials, process mechanisms, equipment, automation, and environmentally responsible practices.

**ME 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ME 7238. Finite Element Method 2. (4 Hours)**

Focuses on advanced techniques for solving engineering problems with the finite element method. Topics include review of finite element method; solution of linear and nonlinear algebraic problems; solution of dynamics problems; solution of contact problems using penalty and Lagrange multiplier methods; solution of nonlinear beams, plates, and shells; finite element formulations of solid continua including Lagrangian and updated Lagrangian formulations, material nonlinearities, and use of a commercially available finite element package.

**Prerequisite(s):** ME 5654 with a minimum grade of C- ; ME 5657 with a minimum grade of C-

**ME 7247. Advanced Control Engineering. (4 Hours)**

Covers topics in modern control engineering, including optimal control, optimal filtering, robust/nonlinear control, and model predictive control. The main theme of the course is how uncertainty propagates through dynamical systems and how it can be managed in the context of a control system. Emphasizes modern tools from computational linear algebra and convex optimization. Uses MATLAB for implementation.

**Prerequisite(s):** EECE 5580 with a minimum grade of C- or EECE 5580 with a minimum grade of C- or EECE 7200 with a minimum grade of C- or ME 5659 with a minimum grade of C- or ME 5659 with a minimum grade of C-

**ME 7270. General Thermodynamics. (4 Hours)**

Examines fundamentals of equilibrium thermodynamics. Topics include work, energy, heat, temperature, available energy, entropy, first and second law of thermodynamics, simple systems, closed and open systems, availability loss and irreversibility, heat engines, multicomponent systems, mixtures of gases, chemical reactions, and chemical equilibrium.

**ME 7275. Essentials of Fluid Dynamics. (4 Hours)**

Offers a fundamental course in fluid dynamics designed to prepare the student for more advanced courses in the thermofluids curriculum while providing a strong background in fluid mechanics. Topics include Cartesian tensors; differential and integral formulation of the equations of conservation of mass, momentum, and energy; molecular and continuum transport phenomena; the Navier-Stokes equations; vorticity; inviscid incompressible flow, the velocity potential, and Bernoulli's equation; viscous incompressible flow; the stream function; some exact solutions; energy equation including heat conduction and viscous dissipation, low Reynolds number flow, exact and approximate approaches to laminar boundary layers in high Reynolds number flows, stability of laminar flows and the transition to turbulence, and treatment of incompressible turbulent mean flow; and internal and external flows.

**Prerequisite(s):** ME 6200 with a minimum grade of C-

**ME 7278. Complex Fluids. (4 Hours)**

Covers the physical phenomena in complex fluids, including polymeric liquids, structured fluids, and cells and biofluids undergoing deformation and flow. Focuses on kinematics and material functions for complex fluids; techniques of viscometry, rheometry, and linear viscoelastic measurements for such fluids; mathematical expressions and constitutive laws describing rich and complex behavior of complex fluids under different flow conditions; continuum mechanics frame invariance and convected derivatives for finite strain viscoelasticity; differential and integral constitutive equations for viscoelastic fluids; the roles of non-Newtonian behavior, linear viscoelasticity, and time- and rate-dependent properties of a wide range of fluids, from cells and saliva, to oil and polymers, with examples on normal stresses; elastic recoil; stress relaxation in processing flows; molecular theories for dynamics of complex fluids; and more.

**Prerequisite(s):** ME 7275 with a minimum grade of C-

**ME 7285. Heat Conduction and Thermal Radiation. (4 Hours)**

Emphasizes analytical techniques in conduction and radiative transfer. Topics include formulation of steady- and unsteady-state one-dimensional and multidimensional heat conduction problems, solution techniques for linear problems including the method of separation of variables, Laplace transforms and integral transforms, approximate analytical methods, phase change problems, and nonlinear problems. Offers an introduction to thermal radiation heat transfer including the electromagnetic background of radiation, nature of thermal radiation, radiation intensity, black body intensity, and radiation through nonparticipating media. Discusses the fundamentals of radiation in absorbing, emitting, and scattering media including the equation of radiative transfer with methods of solution, pure radiative transfer in participating media, and interaction of radiation with conduction and/or convection. Requires undergraduate heat transfer course.

**Prerequisite(s):** ME 6200 with a minimum grade of C-

**ME 7290. Convective Heat Transfer. (4 Hours)**

Focuses on the fundamental equations of convective heat transfer including heat transfer in incompressible external laminar boundary layers, integral boundary layer equations, laminar forced convection in internal flows, and turbulent forced convection in internal and external flows. Develops analogies between heat and momentum transfer including the Reynolds, Taylor, and Martinelli analogies. Covers natural convection, heat transfer in high-speed flow, and transient forced convection.

**Prerequisite(s):** ME 7275 with a minimum grade of C-

**ME 7295. Multiscale Flow and Transport Phenomena. (4 Hours)**

Covers the fundamentals of flow and transport phenomena in multiscale systems. Begins with an overview of momentum, energy, and mass transport phenomena, emphasizing microscale phenomena such as the slip flow regime. Introduces other driving forces and transport processes relevant to microscale flows, such as surface tension (capillarity) and electrokinetics. These basic concepts provide the preamble for the presentation of the more complex multiphase and porous flow transport behavior. This course material is supplemented with class projects and presentations by the students. Requires knowledge of thermodynamics, fluid mechanics, and heat transfer.

**ME 7300. Combustion and Air Pollution. (4 Hours)**

Deals with the formation of pollutants during combustion processes and their subsequent transformations in the atmosphere. Emphasis is on the effects of design and operating parameters of combustion devices on the nature and composition of exhaust gases, improvements, postcombustion treatment of effluent gases, atmospheric chemistry, and atmospheric transport of pollutants, smog formation, acid rain, ozone formation, and destruction.

**ME 7305. Fundamentals of Combustion. (4 Hours)**

Provides an advanced course that is a comprehensive treatment of the problems involved in the combustion of liquid, gaseous, and solid fuels in both laminar and turbulent flow. Discusses the fundamentals of chemical kinetics. Examines the equations for the transport of mass, momentum, and energy with chemically reacting gases. Topics include diffusion and premixed flames, combustion of droplets and sprays, and gasification and combustion of coal.

**Prerequisite(s):** ME 7270 with a minimum grade of C-

**ME 7310. Computational Fluid Dynamics with Heat Transfer. (4 Hours)**

Offers an advanced course in numerical methods applied to fluid flows with heat transfer. Topics include finite difference and finite volume methods for solving partial differential equations, with particular emphasis on the equations of fluid dynamics and heat transfer. Other topics include mathematical properties of partial differential equations, accuracy and stability analysis of numerical solutions, applications to a variety of fluid dynamics and heat transfer problems, grid generation, and an introduction to turbulence modeling. Requires knowledge of computer programming.

**Prerequisite(s):** ME 7275 with a minimum grade of C-

**ME 7374. Special Topics in Mechanical Engineering. (4 Hours)**

Offers topics of interest to the staff member conducting this class for advanced study. May be repeated without limit.

**ME 7440. Mechanical Engineering Leadership Challenge Project 1. (4 Hours)**

Offers students an opportunity to develop and present a plan for the demonstration of a marketable technology product or prototype with a mechanical engineering focus. Constitutes the first half of a thesis-scale project in technology commercialization. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological and engineering depth and fostering the student's leadership development.

**ME 7442. Mechanical Engineering Leadership Challenge Project 2. (4 Hours)**

Continues ME 7440, a thesis-scale project in technology commercialization. Offers students an opportunity to demonstrate their development of a marketable technology product or prototype with a mechanical engineering focus and to produce a written documentary report on the project to the satisfaction of an advising committee. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological and engineering depth and fostering the student's leadership development.

**Prerequisite(s):** ME 7440 with a minimum grade of C-

**ME 7945. Master's Project. (4 Hours)**

Offers theoretical or experimental work under individual faculty supervision.

**ME 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ME 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated up to eight times for a maximum of 8 semester hours.

**ME 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**ME 7990. Thesis. (4 Hours)**

Offers analytical and/or experimental work conducted under the direction of the faculty in fulfillment of the requirements for the degree.

**Prerequisite(s):** ME 7945 with a minimum grade of C-

**ME 7996. Thesis Continuation - Half-Time. (0 Hours)**

Continues thesis work conducted under the supervision of a departmental faculty member.

**ME 8960. Candidacy Preparation—Doctoral. (0 Hours)**

Offers students an opportunity to prepare for the PhD qualifying exam under faculty supervision. Intended for students who have completed all required PhD course work and have not yet achieved PhD candidacy; students who have not completed all required PhD course work are not allowed to register for this course. May be repeated once.

**ME 8986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**ME 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of program requirements for PhD candidacy.

**ME 9986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**ME 9990. Dissertation Term 1. (0 Hours)**

Offers dissertation supervision under individual faculty supervision.

**Prerequisite(s):** ME 9000 with a minimum grade of S

**ME 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** ME 9990 with a minimum grade of S

**ME 9996. Dissertation Continuation. (0 Hours)**

Offers continuing dissertation supervision under individual faculty supervision.

**Prerequisite(s):** ME 9991 with a minimum grade of S or Dissertation Check with a score of REQ

**Mechanical Engineering Technology - CPS (MET)**

**MET 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MET 2000. Engineering Computer-Aided Design and Tolerance Analysis. (3 Hours)**

Covers design topics relative to the creation, modification, analysis, and optimization of engineering components and assemblies with extensive use of selected computer-aided design software (CAD). Concentrates on the use of contemporary parametric and/or explicit CAD modeling, management of associative relationships between geometries, and digital prototyping. Studies the role of CAD in product development and product life-cycle management. Involves extensive hands-on practice using commands and featured capabilities of the selected CAD software and completion of individual or team design projects. Projects focus primarily on mechanical systems design. Emphasizes accurate dimensioning, symbol interpretation, and accurate tolerancing of digital designs. Also includes introductory topics of graphical analysis of mechanical stress of elements and assemblies.

**Prerequisite(s):** GET 1150 with a minimum grade of D-

**MET 2040. Engineering Manufacturing Process. (3 Hours)**

Introduces learners to engineering materials, property enhancement technologies, metrology, assembly operations, and rapid prototyping. Discusses a variety of methods for improving bulk and surface properties based on materials compositions, structures, and desired performance. These include heat treatment, plasma surface engineering, and other vacuum technologies. Introduces industrial robotics, numeric control, and programmable logic controllers. Studies and discusses production systems, process planning and quality control, and production inspection based on various industrial applications.

**MET 2100. Mechanics 1: Statics. (3 Hours)**

Introduces the fundamental concepts and principles needed to analyze the mechanical equilibrium of engineering systems. Topics include Newton's fundamental laws, systems of units, vector operations, forces, mechanical equilibrium of particles and rigid bodies, moments of forces, moments of couples, free-body diagrams, 2D and 3D equilibrium of bodies, centers of gravity, centroids, concentrated and distributed loads, analysis of mechanical structures, dry friction, moments of areas and inertia, and an introduction to the concepts and definitions of mechanical work and potential energy.

**Prerequisite(s):** (MTH 2105 with a minimum grade of D- or MTH 2120 with a minimum grade of D- ); PHY 1200 with a minimum grade of D-

**MET 2200. Mechanics 2: Dynamics. (3 Hours)**

Expands and uses the underlying principles and concepts of Newtonian mechanics to study, analyze, and solve problems relative to mechanical systems in motion. Explores approaches to analyze motion both neglecting and considering the cause of motion and their relationship to the design of engineering systems. Discusses subjects pertaining to the study of kinematics and dynamics of particles and rigid bodies in detail. Topics include linear, curvilinear, and rotational motion of particles and rigid bodies, as well as conservation principles and concepts and inherent definitions for the analysis and design of dynamic systems such as velocity, acceleration, linear and angular momentum, impulse, forces, work, kinetic and potential energy, total mechanical energy, and power.

**Prerequisite(s):** MET 2100 with a minimum grade of D-

**MET 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MET 3300. Engineering Materials Science. (3 Hours)**

Studies the foundation of physical and chemical characteristics, properties, behavior, and selection. Discusses the influence of fabrication and treatment methods on the characteristics of typical materials used in engineering applications including metals, ceramics, polymers, and composites. Topics include crystalline and noncrystalline structures, lattices, point defects, and dislocations. Also covers mechanical, thermophysical, and electrochemical characteristics of materials such as hardness, mass diffusion, and electroplating, as well as ferrous and nonferrous metal alloys, the structure and properties of ceramics, fundamentals of polymer science and technology, and synthetic and laminar composites.

**MET 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MET 4100. Mechanical Engineering Systems Design. (3 Hours)**

Covers the fundamental principles of mechanical design including details of the engineering design process, design factors, creativity, optimization, safety, and value engineering. Discusses properties and selection of common engineering materials used in design and manufacturing of mechanical components and machines. Focuses on analysis and design of typical machine elements that operate under mechanical loads and stresses, including shafts, gears, bearings, belt and chain drives, clutches, brakes, fasteners, springs, torsion bars, power screws, linear actuators, and joints. Integrates computer usage for efficient and rapid design, formulae evaluation, mathematical simulation, design selection and optimization, and virtual prototyping. Discusses additional elements of engineering design such as cost analysis, robustness, quality improvement, and environmental concerns.

**Prerequisite(s):** MET 2000 with a minimum grade of D- ; MET 3300 with a minimum grade of D-

**MET 4950. Seminar. (1-4 Hours)**

Offers an in-depth study of selected topics.

**MET 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**MET 4983. Topics. (1-4 Hours)**

Covers special topics in mechanical engineering technology. May be repeated without limit.

**MET 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MET 4991. Research. (1-4 Hours)**

Offers students an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**MET 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic.

**MET 4994. Internship. (1-4 Hours)**

Provides students with an opportunity for internship work.

**Attribute(s):** NUpath Integration Experience

**MET 4995. Practicum. (1-4 Hours)**

Provides eligible students with an opportunity for practical experience.

**MET 4996. Experiential Education Directed Study. (1-4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major.

**Attribute(s):** NUpath Integration Experience

## Media and Screen Studies (MSCR)

**MSCR 1000. Media and Screen Studies at Northeastern. (1 Hour)**

Intended for freshmen media and screen studies majors and combined majors. Introduces students to the liberal arts in general. Offers students an opportunity to become familiar with media and screen studies as a major discipline; to develop the academic skills necessary to succeed (analytical ability and critical thinking); to become grounded in the culture and values of the university community (including advising); and to develop interpersonal skills—in short, to become familiar with all the skills needed to become a successful university student.

**MSCR 1100. Film 101. (4 Hours)**

Focuses on the ways in which cinematic language and representations have developed since the late-nineteenth century, how representations of human difference vary in distinct cultural contexts, and how particular filmmakers and historical/national movements have challenged certain representations and ideologies. This range of representations and discourses includes blackface performance and other racist tropes, ethnographic studies of indigenous people as "exotic" curiosities, films noir that demonize independent women, postwar Italian neorealism's revolutionary focus on the plight of the poor, films by and about marginalized ethnicities in the U.S. and the global south, banned films that highlight the condition of women in post-revolution Iran, and contemporary Hollywood's treatment of homosexuality and masculinity.

**Attribute(s):** NUpath Difference/Diversity

**MSCR 1220. Media, Culture, and Society. (4 Hours)**

Introduces the study of media, including print, radio, film, television, and digital/computer products. Explores the ideological, industrial, political, and social contexts that impact everyday engagements with media. To accomplish this, students examine how media products are developed, how technological changes impact the production and consumption of media, how political processes are influenced by media, how people interpret and interact with media content, and how media influence cultural practices and daily life.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**MSCR 1230. Introduction to Film Production. (4 Hours)**

Offers an introduction to production that blends theory and practice of film/video production through an examination of exemplary works, aesthetic strategies, production techniques, and the dynamic relationship between media makers, subjects, viewers, and technology. Offers students an opportunity to gain fundamental moving-image fluency using widely accessible media production tools including camcorders, mobile phones, and digital single-lens-reflex cameras.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**MSCR 1320. Media and Social Change. (4 Hours)**

Explores media's role in movements for social, economic, and cultural change. Specifically examines how people use media technologies to organize themselves and communicate their message to wider audiences in order to achieve social change. As a way to develop and improve ethical reasoning, students are asked to think about the accountability of media institutions and actions of groups and individuals who use media technologies and tactics in the name of social change.

**Attribute(s):** NUpath Ethical Reasoning

**MSCR 1420. Media History. (4 Hours)**

Examines the historical relationships between media, culture, and society with a focus on the role of media technologies as tools of communication. Emphasizes the broad social and cultural conditions that shape media and the ways in which people experience culture and understand meaning. Introduces the concept of mediation to analyze how different forms of communication have emerged in different historical moments. Critically examines past interactions between media and culture, and also examines the emergence of historically specific conceptions of audience, identity, content, industry, information, perception, and so forth.

**MSCR 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MSCR 2160. Narrative Filmmaking. (4 Hours)**

Introduces narrative filmmaking without synch sound. Offers students an opportunity to create several short projects without dialogue. The successful student leaves the course with a portfolio of work, a basic knowledge of video cameras, and one editing software program (either Avid or Final Cut Pro). Focuses on storytelling through visuals.

**Attribute(s):** NUpath Creative Express/Innov

**MSCR 2220. Understanding Media. (4 Hours)**

Designed to give students a foundation in the theories and methods of analysis in cultural and media studies. Positioned between the introductory MSCR classes and the higher-level theory classes. Offers students an opportunity to learn the how and why of media and cultural studies, focusing on the foundational assumptions, theories, and methods of the discipline.

**Prerequisite(s):** MSCR 1220 (may be taken concurrently) with a minimum grade of D-

**Attribute(s):** NUpath Interpreting Culture

**MSCR 2255. New Media Workshop. (4 Hours)**

In New Media Workshop, students learn foundational tools and techniques of new media production with a focus on the cultural and expressive implications of using new media forms, including hypertext, games, maps, augmented reality, and virtual reality. Students create a portfolio of projects to explore and refine the relationship of form and of content in new media. Topics include nonlinear storytelling, play and games, place-based storytelling, interactivity, and immersion.

**MSCR 2300. Television: Text and Context. (4 Hours)**

Introduces students to critical television studies. Topics include visual language (use of image, music, graphics, editing, and sound); narrative structure; and genre. Specific critical approaches include semiotics, narrative and genre analysis, feminist analysis, and ideological analysis of representation.

**Attribute(s):** NUpath Interpreting Culture

**MSCR 2325. Global Media. (4 Hours)**

Covers global dynamics of media and media systems. Specifically seeks to introduce students to the nuances of globalization and cultural performance through media structures. Introduces a wide variety of topics that fall in the intersection between globalization and media and the ways in which they operate socially and culturally. The course focuses broadly on understanding—in both theoretical and practical ways—how and why global media function as they do and how they contribute to knowledge formation and social justice within various cultural contexts.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**MSCR 2330. Film Genres. (4 Hours)**

Examines a number of foundational texts on genre analysis. Addresses how and why films are classified according to particular iconographies, tropes, and narrative structures and the ways in which audiences coalesce around and appropriate particular genres for building communities. Studies some of the most iconic of genres—the Western (the mythologized and preindustrial past), film noir (the present time of industrial and postindustrial capitalism and urbanization), and science fiction (the imagined future)—from their origins; through their classical period; and, ultimately, to generic revision, self-reflexivity, hybridity, and parody.

**Attribute(s):** NUpath Interpreting Culture

**MSCR 2335. Race and Social Justice in American Film. (4 Hours)**

Offers an in-depth analysis of and reflection upon films and how they influence our perceptions of race in the United States. Examines how race and its representation shapes the development, production, distribution, and marketing of American documentaries and dramas. Uses screenings, readings, lectures, discussions, and writing to explore the power of films to reflect and reinforce long-standing ideologies of race and analyze how traditionally underrepresented groups have historically shaped counter-narratives.

**Attribute(s):** NUpath Difference/Diversity

**MSCR 2336. American Film and Culture. (4 Hours)**

Surveys the rise of American film from the late nineteenth century to the present. Examines key films, directors, major themes, and film forms and techniques. Includes lectures, screenings, and discussions. Students who do not meet course prerequisites may seek permission of instructor.

**Attribute(s):** NUpath Interpreting Culture

**MSCR 2337. True Crime Media. (4 Hours)**

Analyzes the narrative conventions of the true crime genre and explores the historical and cultural origins of true crime as a storytelling mode. Examines the industry conditions that affect true crime coverage and analyzes the social and political dynamics that shape and are shaped by true crime narratives in commercial media.

**Attribute(s):** NUpath Interpreting Culture

**MSCR 2391. Character, Conflict, and Dialogue. (4 Hours)**

Focuses on practical ways to write dimensional characters, drive story conflict, and craft authentic dialogue in screenwriting. Introduces techniques to shape characters by specifically exploring the internal world of the character wherein they may either face or resist conflict, deal with or deny unexpected change, and embrace or abandon meaningful relationships. Covers the creation of a detailed character biography, compelling backstory, and psychological profile for each major character in order to believably inform their conscious and unconscious actions and behavior. Explores various dialogue techniques with which a character may express themselves tied directly to the character's life experiences, personality, outlook, and behavior.

**MSCR 2450. Sound Cultures. (4 Hours)**

Explores the intersection of sound, media, and culture. Introduces students to theories and methods to analyze media technologies, cultural practices, and politics of sound. Examines how considerations of power shape the ways people create, amplify, and use sound in media, with an ear toward identity, representation, and complex relationships of technology and culture. Engages a variety of sound media, sonic cultural practices, and sound technologies through a variety of in-class activities and projects. Offers students an opportunity to apply these ideas to highly relevant, real-world personal, political, and cultural questions about sound, media, and power in everyday life.

**Attribute(s):** NUpath Interpreting Culture

**MSCR 2455. Disinformation and Other Media Disorders. (4 Hours)**

Examines the long history of new media that have been said to threaten existing social orders—from 18th-century pamphlets to Nazi propaganda films and astrology columns to generative AI. Illuminates the central role that media genres, technologies, practices, and institutions have played in creating the modern category of “society” itself. Explores the relationship between media and private life, markets, and the state using a diverse set of case studies. Canonical and contemporary theories introduce key concepts ranging from stereotypes, ideology, and publicity to moral panic, agnotology, and disinformation.

**Attribute(s):** NUpath Societies/Institutions

**MSCR 2505. Digital Feminisms. (4 Hours)**

Explores the unique ways that feminist activism and theory are impacted by the increasing digital nature of our world. From hashtags to Tumblr, feminists are using digital tools and platforms to aid in the pursuit of social justice. Offers students an opportunity to develop a timeline that traces feminists’ engagement with the Internet, new media, and technological innovations from the late seventies to the present. Examines the strengths and challenges that the digital world creates for feminist engagement. MSCR 2505 and WMNS 2505 are cross-listed.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**MSCR 2600. Cloud, Closet, (Drop)Box. (4 Hours)**

Explores the multiple and complicated ways in which our lives and ways of thinking are impacted by what things we decide to keep and how we organize access to them, i.e., storage, defining media as technologies that help organize information. Uses readings, podcasts, short films, and TV shows to examine storage to understand the emergence of the cloud and other contemporary media “containers.” Considers what the future of storage holds as individuals and institutions try to find space and time to store and retrieve our data, memories, clothes, food, and more.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**MSCR 2895. Film Analysis. (4 Hours)**

Introduces the ways in which films are produced, marketed, and distributed, along with the basic elements of film grammar, from shot construction to editing to sound. Offers students an opportunity to learn how film analysis is conducted, including an introduction to the study of film genre, film history, and film theory. Covers basic concepts regarding the relationship between film and culture, including national and regional identity; the relationship between a film “text” and the audience; and the relationship between film and other forms of cultural production such as art, literature, music, and theatre. Aims to provide a nuanced understanding of a variety of cinematic works as products of specific cultures, times, and places.

**Attribute(s):** NUpath Interpreting Culture

**MSCR 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MSCR 2991. Research in Media and Screen Studies. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision.

**MSCR 3330. Documentary Film Ethics. (4 Hours)**

Explores the history and style of documentary cinema, focusing on the ethics and social impact of various documentary techniques. Introduces theories and methods to analyze and evaluate the ethical dimensions of documentary filmmaking and viewership. Explores how ethical considerations shape the aesthetic choices that documentary filmmakers make and how these choices relate to justice, fairness, and the rights and responsibilities of viewers and filmed subjects. Through discussions of various documentaries, offers students an opportunity to apply these ideas to highly relevant and real-world personal, social, political, historical, and economic questions and situations that are featured in these films.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Ethical Reasoning, NUpath Writing Intensive

**MSCR 3389. Screenwriting. (4 Hours)**

Approaches the unique narrative form of the dramatic short film, with the goal of having students produce a short film screenplay (under twenty minutes in length) which could eventually be shot. Takes students through the storytelling process, from conception to visualization, dramatization, characterization, and dialogue, ending in a project which should reflect the student's own personal voice and unique vision. Offers students an opportunity to work on many writing exercises involving free association, visualizations, and character explorations, and to evaluate and critique each other's work in a workshop setting.

**Attribute(s):** NUpath Creative Express/Innov

**MSCR 3390. Screenwriting: Feature Films. (4 Hours)**

Features an array of screenwriting tools and techniques used in the process of developing ideas into screenplays for feature films. Offers instruction in writing highly effective scenes; building compelling and dimensional characters; crafting authentic dialogue; and a variety of methods to add texture, depth, and meaning to a story. Students develop an outline for a feature film that they refine through ongoing in-class workshops based on informed and supportive collaboration. The cumulative nature of the course encourages students to learn, practice, and demonstrate a wide range of foundational skills they can continue to build upon to finish their feature film screenplay and apply to any future screenplay ideas.

**MSCR 3392. Gender and Film. (4 Hours)**

Examines the representation of gender in film. Uses concepts and research from film and media studies to investigate the influences and consequences of gender representations in film. WMNS 3392 and MSCR 3392 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity

**MSCR 3420. Digital Media Culture. (4 Hours)**

Investigates social and cultural dynamics emerging parallel to the spread of digital technologies, from the 1960s to the present. Analyzes the impact of technologies (such as computers, mobile phones, and video games) on media products and practices (such as remix culture, social media, and surveillance). Offers students an opportunity to develop the skills that are necessary to critically examine and write about digital media content and the technologies necessary for their consumption.

**Prerequisite(s):** ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**MSCR 3422. Media Audiences. (4 Hours)**

Explores how mass media audiences interpret and actively use media messages and products as listeners, readers, and consumers. Examines the different stages of ethnographic research, audience meanings and interpretations, pleasure and fanship, the role of media in everyday life, and the use of ethnographic research methods in communication studies. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**MSCR 3437. Media and Identity. (4 Hours)**

Examines representations of identity (race, gender, sexuality, and class) in the media, investigates their influences, and considers their repercussions. The class especially focuses on understanding identity as a construction, rather than as inherently "natural." Broadly, we discuss the relationship between identity and media representations; more specifically, we look at cultural texts, sites, and practices where the existing racial categories mix, merge, and/or rub up against each other in ways that problematize the naturalness of essentialized identities. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** MSCR 1220 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity

**MSCR 3446. Documentary Production. (4 Hours)**

Focuses on single-camera video production in service of crafting documentary stories. Offers students an opportunity to learn nonfiction storytelling by examining documentary history and theory as well as participating in screenings, workshops, and hands-on projects designed to prepare them to take an idea and develop it into a final five-to-seven-minute final documentary short. Requires supplemental technical assignments for students with no previous production experience.

**Attribute(s):** NUpath Creative Express/Innov

**MSCR 3450. Directing Video. (4 Hours)**

Students will deconstruct existing fiction films and scripted television/web examples and, in their own pieces, study dramatic structure and implement tone across all technical departments. Students will practice the director's role in communicating vision through casting, scene study, mise-en-scène and post-production, including picture editing, sound design, musical score, graphics and color correction.

**MSCR 3600. Film Theory. (4 Hours)**

Explores the movement from modernist concern with the art object to postmodern concerns with subjectivity and spectatorship, race, and gender. Requires a paper using formalist analysis and later revision using cultural analysis, psychoanalysis, philosophy of perception, race studies. Also offers students an opportunity to learn research methods in cinema studies and perform a metacritical review of their own work and to present their findings from film journals, databases, Web sites, blogs. Presents the relation of perception to reality; levels of representational realness; reception theory; digitalization in its relation to movement and meaning. Seeks to enable students to recognize structures and problems for analysis in a film and to apply appropriate theoretical models to analyze these structures.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**MSCR 3700. Queer Media. (4 Hours)**

Examines queer representation within media, ranging from film and television to social networks and video games. Offers students an opportunity to read, present, and write about theories of difference from a diverse range of perspectives within the interdisciplinary fields of queer theory and media studies.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Writing Intensive

**MSCR 3920. Topics in Film Studies. (4 Hours)**

Focuses on a specific issue and topic in film studies. Course content varies from semester to semester.

**MSCR 3973. Special Topics in Media and Screen Studies. (4 Hours)**

Addresses issues in communication and media as well as developments in the production of television and video. Course content may vary from year to year. Students who do not meet course prerequisites may seek permission of instructor. May be repeated up to four times.

**MSCR 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MSCR 4208. TV History. (4 Hours)**

Explores U.S. network television in the "precable" era, which ranges from 1949 to the 1980s. Studies television programming through its historical, cultural, and industrial contexts. The media studies component of the class considers topics such as aesthetics, narrative, genre, and representation.

**Prerequisite(s):** ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**MSCR 4602. Media and Democracy. (4 Hours)**

Introduces the role of the media in democratic societies. Explores a number of important questions, including what is democracy? What types of information do citizens of a democracy need in order to participate in the governance of their lives? In our increasingly digital world, where do political discussions happen? Are the media responsible for keeping the public informed? Who constitutes the "public"? Are we citizens? Consumers? Producers? Who decides? In order to address these questions, students have the opportunity to become conversant in a variety of modern and contemporary theoretical and critical perspectives on the relationship between the media, democracy, and what has come to be known as the public sphere. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** MSCR 3423 with a minimum grade of D- or MSCR 3435 with a minimum grade of D- or MSCR 3437 with a minimum grade of D-

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**MSCR 4623. Media and Screen Studies Capstone. (4 Hours)**

Focuses on key concepts and ideas from media and screen studies to prepare students to complete a final project in a format of the student's choice: research paper, short narrative film, documentary, podcast, photo essay, or short film screenplay.

**Prerequisite(s):** MSCR 1220 with a minimum grade of D- or COMM 1220 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience

**MSCR 4970. Junior/Senior Honors Project 1. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated without limit.

**MSCR 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MSCR 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**MSCR 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**MSCR 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**MSCR 5300. Media and Technology Ethics. (4 Hours)**

Studies technology ethics from the perspective of media and technology studies. Case studies raise specific issues such as selfhood, autonomy, privacy, as well as the implications of such technology for important moral concepts such as agency, responsibility, and privacy; inclusion and opportunity; surveillance and security; and truth, deliberation, public rationality, and disinformation. Offers students an opportunity to identify and distinguish ethical challenges particular to information and media technology.

**Attribute(s):** NUpath Ethical Reasoning

**MSCR 6100. Digital Media: Theory and Practice. (4 Hours)**

Introduces the practice of media making for graduate students with little to no experience producing media. Covers the foundational language of images, movement, editing, and sound by creating work in stand-alone media such as short fiction and documentary, serial (multipart) media, and sound editing for podcasting. Examines the theories of power and representation that are integral to media making. No previous experience with media production is necessary.

**MSCR 6310. Critical Data Studies. (4 Hours)**

Raises critical questions about how society and culture interact with data, acknowledging that data is at the core of our culture and social organization. Emphasizes how data is produced, circulated, and used in different ways, taking an interdisciplinary approach rooted in media studies critiques of technology and power. Case studies discuss what it means to locate the making and using of data within social relations of power, that is, to critically analyze data.

**MSCR 6320. Digital Technologies and Global Society. (4 Hours)**

Presents key empirical and conceptual foundations to provide tools to address the complex challenges that digital technologies pose in a global context of social relations of power. Emphasizes the origins of the contemporary internet in imperial and military history and explores alternative possibilities that never came to be realized. A series of case studies, drawn primarily from the Global South, analyze power dynamics to highlight the pressing ethical and political questions raised by cutting-edge technologies.

**MSCR 6330. Democracy, Technology, and Equality. (4 Hours)**

Considers via an interdisciplinary approach how the development and use of digital technology by different political actors shapes and transforms democratic societies. Uses case studies to emphasize debates about the type and quality of information in democracies, as well as concerns about polarization and a general fraying of social cohesion.

**MSCR 6340. Race and Technology. (4 Hours)**

Investigates how individual and collective beliefs about what it means to be a human of a particular race, ethnicity, or caste is reflected in contemporary and emergent technologies. From biometric scanners at the airport to social media interfaces, the tech tools people use every day are shaped by the sociocultural constructs of race and racial hierarchies, with an array of consequences. Grounded in the theories of communication and media studies, it is an expansive interdisciplinary investigation of how our understanding of who we are shapes what we create and how what we create, re-creates us.

**Medical Sciences (MSCI)****MSCI 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MSCI 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MSCI 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**MSCI 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MSCI 5001. Human Factors and Situational Awareness. (3 Hours)**

Investigates the human factors and stressors that may be encountered by professionals engaged in expedition medicine and clinical practice. Explores several core concepts including collaboration and lateral thinking, time-pressured tasks, incentivizing, sleep deprivation, and debriefing. Offers team-based activities that utilize didactics, group work, and gaming to accomplish an array of tasks.

**MSCI 5002. Crisis Resource Management and Case Studies. (3 Hours)**

Investigates the history of crisis resource management and reviews the characteristics of high-performance teams. Explores expectation violation; surprise; cognitive bias; cognitive unloading; clinical decision making; and methods for debriefing, mitigation, and planning.

**MSCI 5003. Humanitarian Aid Practice and Principles. (3 Hours)**

Explores the principles and concepts of the provision of humanitarian aid. Reviews the context of humanitarian crises, using a case-based approach. Covers international organizational structures and NGOs, as well as methods of deployment, communication, and longitudinal follow-through. Explores safety issues and the ethics of humanitarian and disaster response.

**MSCI 5004. Humanitarian and Disaster Response Ethics. (3 Hours)**

Explores the principles that govern disaster and humanitarian response. Examines the basic tenets of ethics, as well as overarching theories and principles. Utilizes a case-based approach to build on ethical issues that have emerged in humanitarian and disaster response, including medical tourism, lack of longitudinal care, and human trafficking.

**MSCI 5005. Care During Conflict. (3 Hours)**

Investigates the role of medical and humanitarian aid providers in zones of conflict. Addresses issues specific to working in conflict zones, including safety, working with the military, and international laws on war zones and conflict. Covers special circumstances including human trafficking, children in conflict, and trauma-informed care. Emphasizes moral distress and psychological issues.

**MSCI 5400. Experiential Reflections: Bridging Theory and Experience. (1-4 Hours)**

Delves into contemporary training in austere medicine to explore its fundamental principles. Investigates the latest evidence-based practices and supports self-reflection on prior or current practical experiences in extreme conditions. Suggested for individuals currently enrolled in or who have successfully finished an extreme medicine experience.

**MSCI 5401. Human Factors and Situational Awareness Experience. (2 Hours)**

Offers students an experiential opportunity to apply and investigate foundational knowledge and skills regarding human factors and stressors that may be encountered by professionals engaged in expedition medicine and clinical practice. Explores core concepts including collaboration and lateral thinking, time-pressured tasks, incentivizing, sleep deprivation, and debriefing. Offers team-based activities that utilize didactics, group work, and gaming to accomplish an array of tasks.

**MSCI 5402. Expedition and Cold Weather Medicine Experience. (2 Hours)**

Provides experiential opportunities led by a multidisciplinary team. Explores the intersection of medicine, cold weather, and wilderness environments to enhance clinical skills and highlight the role of an extreme healthcare provider. Offers students an opportunity to obtain thorough preparation for practicing medicine in extreme situations—whether in support of local adventures or for long-term treks—through group activities and simulations. Participants must be medical or allied health professionals or in their last two years of study in a medical or allied health professional program.

**MSCI 5403. Expedition and Wilderness Medicine Experience. (2 Hours)**

Provides a comprehensive, experiential opportunity led by a multidisciplinary team. Employs hands-on practical skills training essential to all medical or allied health professionals. Covers dentistry (the first aid management of dental abscess and fractured, intruded, or avulsed teeth in the austere or wilderness environment), tropical medicine, environmental heat and cold exposure, mental health, and expedition planning.

**MSCI 5404. Tactical Medicine Practicum. (2 Hours)**

Provides experiential opportunities led by an expert team of tactical medics with experience in special weapons and tactics, emergency medical service, and law enforcement. Offers participants an opportunity to learn how to respond to high-risk major incidents through a case-based approach, multiple skills stations, and simulation scenarios. Participants must be certified as an EMT, paramedic, or a state-certified law enforcement officer.

**MSCI 5405. Humanitarian Medicine Experience. (2 Hours)**

Provides a comprehensive and impactful introduction to the broad sector of humanitarian medicine including theory, essential skills, and key medical aspects of health intervention. Offers students an opportunity to enhance skills to adapt a professional practice to a new setting and provide real-world impact on human welfare locally and globally. Participants must be medical or allied health professionals or in their last two years of study in a medical or allied health professional program.

**MSCI 5973. Special Topic in Medical Sciences. (1-4 Hours)**

Presents an advanced-level study from a variety of perspectives of contemporary issues in medical science. Offers students an opportunity to expand their breadth of knowledge and to facilitate their understanding of various themes grounded in a particular area of medical science. Course topics vary each semester and are determined by significant events and changes in the field. May be taken more than once, as long as topics are different, and may be repeated up to four times for a maximum of 9 semester hours.

**MSCI 6001. Principles of Healthcare Advocacy. (3 Hours)**

Seeks to prepare healthcare leaders in legislative advocacy and self-advocacy. Legislative advocacy examines relevant health policy research and analysis. Explores self-advocacy aspects within an organization, including communication, interpersonal relationships, and project leadership. Offers students an opportunity to successfully engage in political discussion and advocate for ideas as leaders.

**MSCI 6002. Workforce Metrics: Measuring, Comparing, and Privileging the Interprofessional Healthcare Team. (3 Hours)**

Introduces fundamentals of metrics and analysis surrounding productivity, outcomes, competencies, and retention in a healthcare workforce. Emphasizes applied methodology. Examines dashboard anatomy, metric categories, dashboard analysis, the clinical competency-dashboard relationship, and special considerations for healthcare metric tracking.

**MSCI 6003. Healthcare Leadership Seminar. (3 Hours)**

Surveys general leadership theory, knowledge, and skills to gain insight into differing leadership theories. Emphasizes knowledge and skill in essential healthcare leadership practices such as vision, planning, decision making, communication, interpersonal skills, conflict resolution, motivating and developing others, mentorship, ethical practice, and culture change.

**MSCI 6900. Research Methods and Design. (3 Hours)**

Surveys the principles essential to conduct ethical research in medical sciences. Explores and critically evaluates the concepts, methods, and applications of research and research methods. Offers students an opportunity to propose and develop a research project to inform an important healthcare issue influencing the practice, administration, or policies of healthcare.

**MSCI 6901. Doctoral Writing Seminar. (3 Hours)**

Offers the opportunity to develop and initiate the introduction and background sections of the Doctor of Medical Science thesis. The thesis project focuses on healthcare-related leadership challenges or other approved topics. Designed to support the thesis writing process.

**Prerequisite(s):** MSCI 6900 with a minimum grade of B-

**MSCI 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MSCI 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated.

**MSCI 7990. Thesis. (3 Hours)**

Offers students an opportunity to develop and complete the Doctor of Medical Science thesis. The thesis project focuses on healthcare-related leadership issues or other approved topics.

**Prerequisite(s):** MSCI 6901 with a minimum grade of B-

**MSCI 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers continuing thesis supervision by members of the department.

**Prerequisite(s):** MSCI 7990 with a minimum grade of IP

**Music (MUSC)****MUSC 1000. Music at Northeastern. (1 Hour)**

Intended for freshmen in the College of Arts, Media and Design. Introduces freshmen to the liberal arts in general. Offers students an opportunity to become familiar with their major; to develop the academic skills necessary to succeed (analytical ability and critical thinking); grounding in the culture and values of the university community; and to develop interpersonal skills—in short, to become familiar with all skills needed to become a successful university student.

**MUSC 1001. Music in Everyday Life. (4 Hours)**

Dedicated to exploring, expanding, and exploding traditional meanings of what music is; of what it means to be a composer, performer, and audience member; and of what it means to listen. The overarching goal is to provide students with the tools and opportunities necessary for determining for themselves what place music holds in everyday life.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**MUSC 1002. Music in Everyday Life. (3 Hours)**

Explores and expands on traditional meanings of what music is; of what it means to be a composer, performer, and audience member; of what it means to listen; why music is special; and what gives music the power to sway so dramatically. The overarching goal is to provide students with the tools and opportunities necessary for determining for themselves what place music holds in their everyday lives.

**Corequisite(s):** MUSC 1003

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**MUSC 1003. Lab for MUSC 1002. (1 Hour)**

Accompanies MUSC 1002. Involves discussions of readings, brief writing assignments, and listening exercises introduced in MUSC 1002 .

**Corequisite(s):** MUSC 1002

**MUSC 1004. Basics of Western Music Notation. (1 Hour)**

Prepares students to gain fluency reading and writing standard Western music notation and gain facility with singing and performing rhythms and melodies in various meters, keys, and styles.

**MUSC 1100. Topics in Western Music. (4 Hours)**

Explores select musical forms and styles drawn from the Western art music canon, from the Middle Ages to the present. Introduces fundamental musical concepts and vocabulary. Analyzes selected works in terms of sound, style, and performance practice. These works are contextualized in relation to their sociohistorical context, expectations of patrons and audiences, composer's life and oeuvre, and musical and cultural significance, among other factors. May be repeated once.

**Attribute(s):** NUpath Interpreting Culture

**MUSC 1111. Rock Music. (4 Hours)**

Examines the development of rock-and-roll and its relationship to blues, rhythm and blues, country, folk, and other styles of music. Considers themes such as the role of rock as youth music, the reflections of social realities in rock songs, the relationship of rock to the recording industry and the mass media, and the changing styles of rock. Emphasizes listening skills.

**Attribute(s):** NUpath Interpreting Culture

**MUSC 1112. Jazz. (4 Hours)**

Examines the evolution of the creative improvisational musical styles commonly called jazz, from its African-American roots to its status as one of America's classical musics and an internationally valued art form. Explores the contributions of African and European musical traditions and African-American spirituals, work songs, and blues. Examines major contributors and stylistic development and change through selected audio and audio-visual presentations. Also considers the sociocultural dynamics that have affected musical evolution and acceptance.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**MUSC 1113. Film Music. (4 Hours)**

Emphasizes the various ways that music is used in film, including music depicted on-screen and musical scores. Music is a crucial element of meaning in film, yet its presence is easy to ignore. Offers students an opportunity to learn basic approaches to the analysis of music and sound in film, to develop the ability to think critically about film, and to become knowledgeable about key historical developments in film music and sound. No musical background is necessary.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**MUSC 1118. Music Therapy 1. (4 Hours)**

Examines the application of music as a therapeutic vehicle to release suppressed emotions, to encourage self-expression in psychiatric patients, and to treat a wide variety of disorders. Examines music therapy, in a modern approach to health services, as a supplement to other treatments.

**MUSC 1119. Fundamentals of Western Music Theory. (4 Hours)**

Introduces students with little or no musical experience to all the major and minor key signatures and the following scales: major, natural minor, harmonic minor, and melodic minor. Topics include how to read music in treble clef, bass clef, and various C-clefs; how to identify and construct intervals, triads, and seventh chords; how melody and harmony work together to create a piece of music; roman numeral analyses; and various small forms. Short excerpts are analyzed, and students are required to write musical compositions.

**Attribute(s):** NUpath Creative Express/Innov

**MUSC 1128. Music of Africa. (4 Hours)**

Uses ethnomusicological frameworks and concepts to examine some of the many music cultures on the continent of Africa. Selected cultures are studied through their musical, social, historical, and political heritage. Musical focus includes various vocal and instrumental performance characteristics as well as dance. Covers traditional and contemporary African music. Not open to students who have taken AFRS 1128.

**MUSC 1134. Guitar Class. (4 Hours)**

Provides an introduction to the fundamentals of classical guitar playing for those with or without prior knowledge of the guitar. Covers music reading and theory. Requires students to perform alone and in ensemble with other members of the class. Augments the syllabus by live performances from outside professional and student classical guitarists. Bases final grades on several written examinations and student performance.

**Attribute(s):** NUpath Creative Express/Innov

**MUSC 1136. What's Playing at Symphony?. (4 Hours)**

Offers students an opportunity to attend several performances of the Boston Symphony Orchestra (BSO) at Symphony Hall. Discusses each piece of music from a variety of perspectives, including the history of a given composer and his or her relationship to music history and the history of a given composition and its relevance to the symphonic repertoire. Analyzes program pieces in order to provide a deeper appreciation for their musical construction; however, no musical background is required to participate in this course—it is designed for nonmusic majors and music majors alike. Requires students to purchase BSO College Cards (for a nominal fee) for the current BSO concert season.

**Attribute(s):** NUpath Interpreting Culture

**MUSC 1137. Topics in Diverse Musical Cultures. (4 Hours)**

Introduces students to select musical practices from around the world, with some semesters focusing on a geographic region (i.e., music of Asia) or topic (i.e., music and politics) addressed from a cross-cultural and interdisciplinary perspective. Presents the field of ethnomusicology—"the study of people making music"—and explores musical practices in relation to their sociocultural context and other intersections of the human experience, such as religion, economics, identity, gender, social justice, and politics. Offers students an opportunity to obtain an appreciation of a diverse array of musical traditions and aesthetics and a critical understanding of music as a meaningful form of human expression.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**MUSC 1141. Wired for Sound. (4 Hours)**

Explores the use of electronics in music of various styles and genres from a historical perspective, beginning in the early twentieth century and moving to the present. Examines the methods and means of electronic sound production. Throughout history, technological innovations have influenced music. Starting in the early twentieth century, electricity and, later, electronics, became a key motivating force in music, both in composing and performing and even in listening. Covers the social and cultural conditions under which electric sound was able to evolve.

**Attribute(s):** NUpath Interpreting Culture

**MUSC 1142. Pop, Jazz, and Rock Singing. (4 Hours)**

Focuses on singing techniques used in pop, rock, and jazz. Techniques taught, discussed, and applied in class include breathing, tone and vowel production, singing with power without strain, developing range, improvising, and creating one's own style. Offers students an opportunity to apply these techniques in class, learning through vocal demonstrations in class and through the study of recordings. Singers/songwriters are encouraged to enroll. All levels of singers are welcome; students who enroll should already have the ability to sing generally in tune.

**Attribute(s):** NUpath Creative Express/Innov

**MUSC 1201. Music Theory 1. (4 Hours)**

Introduces melodic and harmonic practices in tonal music with additional work in chord and melody construction. Develops ear training and sight-singing skills.

**Prerequisite(s):** MUSC 1119 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**MUSC 1202. Music Theory 2. (4 Hours)**

Continues MUSC 1201. Focuses on harmonic practices in tonal music. Examines the role and function of harmony through analysis of musical examples and composition of four-voice chorales. Introduces study of advanced harmony. Further develops ear training and sight-singing skills.

**Prerequisite(s):** MUSC 1201 with a minimum grade of C

**MUSC 1204. Analyzing Popular Genres. (4 Hours)**

Examines the role and function of various musical elements by analyzing examples from popular music. Examines structure, lyrics, and instrumentation in popular music. Offers students an opportunity to further develop ear training and sight-singing skills.

**Prerequisite(s):** MUSC 1201 with a minimum grade of C or MUSI 1203 with a minimum grade of C

**MUSC 1205. Piano Class 1. (4 Hours)**

Provides introductory-level study of piano designed for students with or without previous experience. Combines skills in reading music with improvisation and functional piano. Introduces some basic theory to help clarify the structure of class repertoire. Allows students to progress at their own pace. Determines grades by the amount of repertoire mastered during the semester.

**Attribute(s):** NUpath Creative Express/Innov

**MUSC 1301. Introduction to Music Composition. (4 Hours)**

Introduces basic concepts of musical elements, notation, experimentation, and compositional processes and exposes students to several methods of composing musical works. Analyzes works in several genres as potential models including Western art music, contemporary popular music, non-Western styles, and music by living composers, among others. Offers students an opportunity to compose original works of music that draw on these analyses as well as personal influences and inspirations.

**Attribute(s):** NUpath Creative Express/Innov

**MUSC 1901. Music Lessons 1. (1 Hour)**

Offers private instruction in voice or in an instrument. Arranges weekly lessons on a half-hour basis. Contact the music department for arrangements. Requires lab fee. May be repeated without limit.

**MUSC 1902. Music Lessons 2. (1 Hour)**

Offers private instruction in voice or in an instrument. Arranges weekly lessons on a half-hour basis. Contact the music department for arrangements. Requires lab fee. May be repeated without limit.

**MUSC 1903. Composition Lessons. (1 Hour)**

Offers private instruction in music composition. Contact the music department for arrangements. Requires lab fee. May be repeated without limit.

**MUSC 1904. Chorus. (1 Hour)**

Allows students to participate as performers in one or more ensembles under the direction of a faculty conductor. *Prereq: Audition or permission of instructor.* May be repeated without limit.

**MUSC 1905. Concert Band. (1 Hour)**

Allows students to participate as performers in one or more ensembles under the direction of a faculty conductor. May be repeated without limit.

**MUSC 1906. Orchestra. (1 Hour)**

Allows students to participate as performers in one or more ensembles under the direction of a faculty conductor. *Prereq: Audition or permission of instructor.* May be repeated without limit.

**MUSC 1907. Wind Ensemble. (1 Hour)**

Allows students to participate as performers in one or more ensembles under the direction of a faculty conductor. *Prereq: Audition or permission of instructor.* May be repeated without limit.

**MUSC 1911. Jazz Ensemble. (1 Hour)**

Designed to serve both music majors and nonmajors, this is a performance/theory/history offering of the varied styles and techniques of performance in the jazz tradition of African-American music. Students are drawn from all segments of the University. Repertory is taken from the standard jazz literature as well as investigations of new works. Improvisational and interpretational technique are the core content of the course. Both the NU Jazz Ensemble and the NU Jazz Combo are represented together in this course. *Prereq: Audition or permission of instructor.* May be repeated without limit.

**MUSC 1912. Rock Ensemble. (1 Hour)**

Offers students an opportunity to participate in an intermediate-/advanced-level performance group consisting of vocalists, horn section (woodwinds and brass), electric bass and six-string guitar, keyboard, and drum set. Repertoire includes rock, pop, and RB styles. Requires audition or permission of instructor. May be repeated up to eight times.

**MUSC 1913. Blues/Rock Ensemble. (1 Hour)**

Allows students to participate as performers in one or more ensembles under the direction of a faculty conductor. *Prereq: Audition or permission of instructor.* May be repeated without limit.

**MUSC 1914. Pop Music Performance. (1 Hour)**

Offers students of all experience levels an opportunity to rehearse and perform pop music in an ensemble setting. Repertoire varies in style. Open to all without audition. May be repeated up to eight times.

**MUSC 1915. Chamber Ensemble. (1 Hour)**

Allows students to participate as performers in one or more ensembles under the direction of a faculty conductor. *Prereq: Audition or permission of instructor.* May be repeated without limit.

**MUSC 1917. Jazz Choir and Combo. (1 Hour)**

Designed to give students who sing jazz and blues the opportunity to rehearse and perform in a small vocal group. Offers students an opportunity to work on singing in harmony and be featured in solos. The group is also accompanied by a student jazz combo. Members of the combo may register for the course for credit. Requires audition. May be repeated without limit.

**MUSC 1918. World Music Ensemble. (1 Hour)**

Explores music-making traditions from selected world cultures through performance on percussion, voice, and other instruments. No previous music-making experience required. May be repeated up to eight times.

**MUSC 1919. Fusion Ensemble. (1 Hour)**

Offers students an opportunity to participate as performers in one or more ensembles under the direction of a faculty conductor. Focuses on instrumental rock, blues, funk, and jazz repertoire. *Prereq: Audition or permission of instructor.* May be repeated up to eight times.

**MUSC 1920. Pep Band. (1 Hour)**

Offers students an opportunity to participate as performers in one or more ensembles under the direction of a faculty supervisor. The pep band performs at sporting events and other university functions. May be repeated up to eight times.

**MUSC 1922. Open Microphone Performance Workshop. (1 Hour)**

Offers students who sing and/or play an instrument a supportive environment where they have an opportunity to learn performance skills that promote confidence, strong presentation, and meaningful communication with audiences. Students practice strategies for overcoming stage fright and honing musical skills. Examines key aspects of performance such as use of eye contact, movement on stage, solutions to forgetting words/music, various venue circumstances, personal expression, proper microphone technique, and communication with larger and smaller audiences. Students apply these techniques in weekly in-class exercises, regular performances, a final concert, at local open mic nights, and experimenting with virtual reality headsets.

**MUSC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUSC 2101. Black Popular Music. (4 Hours)**

Surveys, investigates, and analyzes black popular music from the end of the 19th century to the present. Through critical listening habits and analytical thinking skills, offers students an opportunity to explore black popular culture as a means of expression, communication, and collective identity, attending to issues of representation, identity, values, and aesthetics through a wide range of interdisciplinary sources and methodologies. Emphasizes intersections of creativity, technology, and performance, along with the impact of music industry, audience reception, and cultural politics. Expects students to complete daily exercises and weekly discussion forums in which they must apply critical thinking to synthesize material, complete comparative analyses, relate individual lessons to key course themes, and connect the curriculum to their own experiences and musical listening practices.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**MUSC 2105. Songs That Made History. (4 Hours)**

Explores the history of the genre of song through a set of examples that have had enormous impact and influence, songs that have "made history." Using songs selected by the faculty based on their expertise, this course aims to identify the social, cultural, musical, and poetic threads that have woven their way through song repertoires, influencing song composition from its origins to the present day. Establishes commonalities and trends in order to understand how "song" has taken on an important cultural status that is unique to a specific time and place and is widespread, linking various songs together.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture, NUpath Writing Intensive

**MUSC 2111. Algebra and Geometry of Music. (4 Hours)**

Engages mathematical thinking in music with regard to its symbolic (how we represent music using numbers and signs); sonic (how mathematical thinking might create insights into musical sound); and grammatical (the logic by which music proceeds from one time to the next) expressions. Music and mathematics both contain objects that exhibit similar properties, such as circularity, similarity, objecthood, spatial dimensionality, dynamics, and processuality. Draws upon various branches of mathematics, including number theory, set theory, algebra, geometry, and statistics. Such representations highlight fundamental musical principles invoked in the process of improvisation, performance, and composition. As such, musical listening is a key component of the course. Ability to read musical notation or musical experience preferred.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Formal/Quant Reasoning

**MUSC 2150. Making a Musical: Analysis, Craft, and Creation. (4 Hours)**

Explores how great musicals are constructed and what tools are needed, focusing on how effective lyrics are built; how songs function in musicals; and how book writers, lyricists, and composers create new works and adapt existing works from other media to the musical theater stage. Offers students an opportunity to transform analytical techniques and discoveries into creative strategies, building short musicals in collaborative teams. Students need not be musicians to participate in this class. Aspiring actors, composers, lyricists, authors of all styles, technical theater artists and designers, and all those with a curiosity about the history of musicals and how musicals are made are strongly encouraged to enroll.

**Attribute(s):** NUpath Creative Express/Innov

**MUSC 2208. Jazz Improvisation. (4 Hours)**

Focuses on repertory as well as performance. Examines the great improvisational artists in American music, such as Charlie Parker, Miles Davis, and John Coltrane. Approaches analysis from a theoretical as well as a practical perspective. Explores the use of rhythm, chords, scales, and modes in the creative improvisation process.

**MUSC 2209. Conducting. (4 Hours)**

Provides instruction in the basic gestures used in conducting vocal and instrumental ensembles. Topics include beat patterns, conveying phrasing and articulation, cueing, controlling tempo and dynamics, score study, and rehearsal techniques. Provides an opportunity for students to constitute a laboratory ensemble for regular practicum.

**Attribute(s):** NUpath Creative Express/Innov

**MUSC 2210. Introduction to Songwriting. (4 Hours)**

Offers an opportunity to learn to construct songs with forward motion and memorable "hooks." Topics include time-proven song forms, melody writing, harmonic tools, lyric writing, collaboration, and production techniques. Emphasizes the craft of writing songs for use in film and television.

**Attribute(s):** NUpath Creative Express/Innov

**MUSC 2211. Advanced Songwriting. (4 Hours)**

Builds on the skills covered in MUSC 2210. Seeks to advance the student's songwriting toolbox via a combination of analysis/transcription, writing, production, critiquing, and analysis. In order to maximize the amount of professional opportunities afforded to the songwriters, this course is highly collaborative in order to model the writing processes most commonly used in the industry. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** MUSC 2210 with a minimum grade of D- ; (MUSC 1119 with a minimum grade of D- or MUSC 1201 with a minimum grade of D- )

**Attribute(s):** NUpath Creative Express/Innov

**MUSC 2310. Popular Music Since 1945. (4 Hours)**

Surveys the evolution of popular music styles in the United States, from the end of World War II to the present day. Examines popular music's development and transformation, highlighting interactions with a wide array of factors including ethnic and gender identities, music business practices, race relations, social and political movements, and technological innovations. Offers students an opportunity to gain a broad overview of the field of popular music studies, its theoretical perspectives and methodologies, and its research sources and materials.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**MUSC 2311. Topics in American Music. (4 Hours)**

Explores the musical heritage of the United States through a range of instructor-selected case studies. Offers students an opportunity to learn to identify various styles of music and relate them to larger discourses on a range of topics, i.e., democracy, cultural pluralism, identity, and other themes in American musical life. Uses weekly instructor lectures, readings of both primary and secondary texts, listening/viewing of multimedia, peer discussion and feedback, and hands-on exercises to analyze and explore the varied role of music in American life.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**MUSC 2312. Topics in Western Art Music. (4 Hours)**

Examines how musical culture works in, and in relation to, the Western art music canon. Explores music selected from the Middle Ages to the present to consider musical structure, style, and performance together with the conditions that shape them, approaches to analyzing and interpreting them, and questions of how music is meaningful within a given time and place. Topics change from semester to semester and may center on such themes as a genre (e.g., the symphony); a historical or style period (e.g., music between the world wars); a set of musicians (e.g., women composers); or an issue or concept (e.g., fantasy). May be repeated once.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**MUSC 2313. Topics in Global Music Cultures. (4 Hours)**

Explores a selection of musical traditions in order to gain an appreciation of musical diversity in terms of aesthetics and meanings. Interrogates the concept of "world music"/"global music" as a way of sustaining binaries between the West and "the rest." Studies the historical, political, economic, social, and aesthetic contexts of varied musical practices to offer students an opportunity to learn how music both reflects and shapes its cultural setting. Through varied pedagogical techniques, presents an informed and critical understanding of music as a meaningful form of human expression.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture, NUpath Writing Intensive

**MUSC 2316. History of the Music Industry. (4 Hours)**

Offers students an opportunity to obtain a thorough grounding in the history of the music industry. Following intensive study of the electronic and print tools available to those interested in researching the music industry, the course initiates historical work in the nineteenth century, when many aspects of the modern music industry took root and blossomed. The remainder of the course is organized around topics drawn from the twentieth and twenty-first centuries, including record companies and marketing, television and the music industry, and the Internet and the music industry. Each unit is accompanied by the most recent and cutting-edge research in the field.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**MUSC 2317. Punk Rock. (4 Hours)**

Explores punk rock as a music genre and a lifestyle, an attitude and a philosophy, a political orientation and a commodified fashion. Everyone's perspective on punk is different, but it also has rules and boundaries. Although it emerged in the 1970s as a reaction against very specific social, cultural, and musical moments in the United States and the United Kingdom, punk has become larger than itself in the intervening decades, spawning sub-subcultures and subgenres that would be unrecognizable to its originators. Addresses punk's long narrative: protopunk genres including garage rock and glam rock; punk's origins in New York City and London; its transformation into postpunk, hardcore, anarcho-punk, and straightedge; and its legacy outside the United States/United Kingdom nexus and in genres such as riot grrrl, grunge, and pop-punk.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**MUSC 2320. 40,000 Years of Music Technology. (4 Hours)**

Surveys the relationship between music and technology from the Paleolithic Age to the present. Examines the origins and impact of diverse musical instruments, with attention to connections between musical and technological developments; the reasons instruments are accepted, modified, or abandoned; and debates about the effects of new technologies on music. Considers such forces as standardization, institutionalization, and commodification, as well as experimentation, hacker, and DIY cultures. Asks whether music technologies are "just tools" or rather carry with them ethical values and ramifications. By studying the sociocultural history of such instruments as the violin, piano, electric guitar and synthesizer, offers students an opportunity to gain an understanding of the interplay between technological change and the enduring human need for music.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions, NUpath Writing Intensive

**MUSC 2330. Musical Communities of Boston. (4 Hours)**

Combines ethnomusicology and experiential learning by exploring the diverse communities of Boston and their music. Since 17th-century encounters between the Wampanoag Nation and English Puritans, Boston has been characterized by intercultural contact and exchange. Discusses the history and legacies of such encounters, as well as present-day issues of diversity and belonging in Boston. Focuses on how communities reinforce their own cultural bonds through music and discusses alliances formed through shared experiences of diasporic, exilic, refugee, immigrant, and minority status. Through interdisciplinary, ethnographic analysis and practice, offers students an opportunity to explore how these inherently intersectional social dynamics—which engage issues of race, gender, class, ethnicity, etc.—play out through collective and individual musical practices.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions, NUpath Writing Intensive

**MUSC 2331. Topics in Musical Communities. (4 Hours)**

Introduces students to diverse local communities of the surrounding area through texts and media, in-class workshops with local musicians and arts workers, experiential activities, and students' own semester-long research projects. Explores a range of musical practices and intersecting issues, which might include music and urban spatial politics; music and gentrification; music, immigration, and diaspora; etc. Offers students an opportunity to engage with music through experiential learning activities, which might include soundwalks, conducting interviews, attending performances, or documenting music through photographs and audio recordings. May be repeated three times.

**Attribute(s):** NUpath Interpreting Culture

**MUSC 2336. The Festival Experience. (4 Hours)**

Examines the ways in which music festivals shape and are shaped by the human desire to gather and celebrate. Through texts, guest lectures, class discussions, festival attendance (as ethnographic researchers), and service-learning alongside festival professionals, offers students an opportunity to learn how organizers make artistic, financial, and administrative decisions to deliver a unique festival experience. Explores the significance, widespread presence, and complex impacts of music festivals. Topics include how festivals shape musical life; what needs and desires festivals meet for producers and attendees; how festivals impact local communities and the natural environment; who defines the social, cultural, economic, and aesthetic values of the festival experience; and what festivals reveal about our history, present circumstances, and future potential.

**Attribute(s):** NUpath Integration Experience, NUpath Societies/Institutions

**MUSC 2340. Divas, DJs, and Double Standards. (4 Hours)**

Examines the significance of gender to the experience of and access to participation in music making, listening, the music industries, and cultural recognition. Surveys how gender differences have been constructed, enacted, and contested in historical and contemporary musical cultures and develops critical lenses for analyzing musical representations of gender difference and their social impact. Considers how gender intersects with racial and sexual identities in music and its institutional structures. Uses case studies drawn from a variety of contexts, such as classical (Bizet's "Carmen"), popular (Beyoncé), film ("Star Wars"), and avant-garde (Yoko Ono).

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions, NUpath Writing Intensive

**MUSC 2350. Acoustics and Psychoacoustics of Music. (4 Hours)**

Introduces students from a variety of disciplines to the fundamentals of sonic production, transmission, and reception. Topics include impedance, refraction and diffraction, wave mechanics, frequency spectrum, and resonance. Applies core concepts to the understanding of the acoustics of musical instruments and loudspeakers. Explores basic auditory psychophysics. Offers students an opportunity to investigate real-life applications in the domains of music, sonic art, sound design, instrumental design, and recording.

**Attribute(s):** NUpath Natural/Designed World

**MUSC 2351. Music, Sound, and the Screen. (4 Hours)**

Examines the function of music and sound design in contemporary visual media: how they are used in relation to images, and how they work with images to generate meaning and shape experience. Topics include film, television, video games, and the internet; and intermedial forms such as title sequences, trailers, music videos, and commercials.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**MUSC 2380. The World of Choral Music. (4 Hours)**

Presents the genre of choral music and its relevance and practical application in choral communities today. Studies a broad list of choral repertoires of both sacred and secular genres (including, but not limited to, Mass, Requiem Mass, cantatas, choral symphony, oratorios) from the Renaissance to the 21st century, as well as music influences derived from multiple cultures. Offers students an opportunity to learn music analysis and apply repertoire analysis in a practical manner of ensemble work. Students experience live performances of works studied, with performances by local choral ensembles, and discuss and reflect on modern-day performance practices/society.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**MUSC 2420. Music Composition Seminar 1. (4 Hours)**

Exposes students to the basic methods of music composition. Analyzes examples from music literature to gain an understanding of the methods employed; students complete several compositions of their own.

**Prerequisite(s):** MUSC 1201 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**MUSC 2425. Arranging and Orchestration for Film, Media, and the Concert Stage. (4 Hours)**

Through the investigation of musical instrument attributes (timbre, range, etc.) and the study of repertoire, introduces the use of orchestral and rock instruments in original compositions and arrangements in Western styles for film, media, and the concert stage. Explores professional standards in notating music in the Western tradition. Delves into best practices in arranging and orchestration in voicing, voice-leading, reharmonization, balance, texture, basic counterpoint, etc. Explores arranging music, both as transcription and as the invention of formal elements like intros, outros, breaks. Explores a range of ensembles (orchestral, rock, jazz ensemble, a cappella, etc.), and styles of music (classical, rock, jazz, pop, musical theatre). Select student arrangements will be performed in class by musicians on the instruments being studied.

**Prerequisite(s):** MUSC 1201 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**MUSC 2600. Music for Your Health. (4 Hours)**

Explores interdisciplinary and transdisciplinary approaches to understanding and activating music's power to influence health and well-being. Offers students an opportunity to obtain the analytical tools required to understand, synthesize, and critique empirical research investigations; evaluate research design, models, and outcomes; and identify future research directions and applications of music-in-health research in music therapy, music medicine, psychology, neuroscience, public health, and medical ethnomusicology. At the population level, discusses music as a health promotion tool and social determinant of health and music access as a health equity issue. Emphasizes diverse approaches across disciplines and cultures to advance physiological, psychological, social, and spiritual health through music. Through self-experimentation and critical reflection, offers hands-on experience with multiple modes of investigation to develop personalized music-based resource toolkits to support well-being.

**Attribute(s):** NUpath Natural/Designed World

**MUSC 2973. Special Topics in Music. (4 Hours)**

Focuses on various topics related to music. May be repeated twice for a maximum of 12 semester hours.

**MUSC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUSC 2991. Research in Music. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision.

**MUSC 3300. Music Perception and Cognition. (4 Hours)**

Offers an overview of the perceptual, cognitive, and brain bases of performing, composing, and listening to music for enjoyment and for human benefit. Topics include acoustics and biological processing of sound; theories and empirical research on pitch, rhythm, harmony, melody, timbre, orchestration; similarities and differences between music and language; evolution and development of musical ability; and special populations in musical functions. Includes laboratory demonstrations and exercises in experiment design and data analysis. Requires a final project (paper and in-class presentation). Offers students an opportunity to learn how to design and conduct their own research study in music perception and cognition.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**MUSC 3342. Critical Listening for Producers. (4 Hours)**

Focuses on developing active listening skills by engaging students in auditioning, analyzing, and discussing a wide range of commercial and popular music productions across diverse genres. Traditional technical ear training techniques are augmented by the use of contemporary digital audio analysis tools such as spectrographs, metering, and AI-driven FFT tools. Covers fidelity, audio reproduction, playback systems, and the impact of streaming and physical media from the perspectives of producers and consumers. Weekly assignments offer students an opportunity to develop critical listening skills and technical vocabulary for evaluating professional music productions.

**Prerequisite(s):** MUSI 2232 with a minimum grade of C or MUST 1220 with a minimum grade of C

**Attribute(s):** NUpath Analyzing/Using Data

**MUSC 3352. Sounding Human. (4 Hours)**

Explores how people have used music to answer the question of what it means to be human and how boundaries between the human and nonhuman (animal, machine, angel, alien, etc.) have been inscribed, dissolved, and reconfigured by means of music. Examines historically how certain musical traits have served as signifiers of humanity, while others have signified nonhumanity. Studies musicians who deliberately present themselves or their work as nonhuman as a means to critique limited conceptions of mankind. Develops historical, critical, and ethical perspectives on what it means to be human by focusing on contexts where music has played a role in testing and contesting conventional wisdom (including colonial encounters, technological changes, scientific studies, and science fiction).

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**MUSC 3353. Music and the Racial Imagination. (4 Hours)**

Addresses the history of the concept of race, taken as a cultural construct and a lived reality, long used to justify social, economic, and political inequality. Examines the relationship between musical sound and processes of racialization, addressing this relationship through a series of select historical and contemporary case studies, alongside grounding texts drawn from critical race studies, gender and sexuality studies, and ethnomusicology and popular music studies. Explores how the construction and everyday lived experience of race influenced music production, performance, reception, and analysis and how categories of race have been represented and questioned through the sonic and embodied acts of performers.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions, NUpath Writing Intensive

**MUSC 3354. Sound and the Sacred. (4 Hours)**

Considers the ways in which religious beliefs, ethics, meaning, and practices are embodied within music and what music contributes to faith identities in a variety of religio-cultural contexts, both present-day and historical. Music plays important roles in religious contexts: Among other things, it connects worshippers to spiritual realms; centers practitioners within continuous traditions; distinguishes between sacred and secular spaces (and places); enables communal cohesion; facilitates transcendent experiences; imbues everyday activities with religious intent; orients believers to ritual practices; and contributes to religious identities, both at the individual and at the collective (or congregational) levels. Approaches the study of music and religion as one that benefits from intense attentional investment, using detailed scholarly works to provide intricately nuanced perspectives.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture, NUpath Writing Intensive

**MUSC 3355. Music, Noise, Silence. (4 Hours)**

Using an ethnomusicological focus, examines listening as a critical cultural practice. Combines analysis with practice-based explorations of listening to address sonic practices from around the globe in order to decolonize our assumptions about how we listen, what we listen for, and how we categorize, analyze, and assign value to the sounds we hear. Engages themes across and beyond ethno/musicology, popular music studies, music cognition, and sound studies, focusing on the social implications of listening in relation to (de)colonization, race, gender, (dis)ability, technology, environmental crisis, and human-animal interactions; and through activities including listening experiments, sound walks, and sonic art.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture, NUpath Writing Intensive

**MUSC 3360. Ethnography and the Arts. (4 Hours)**

Considers what ethnography might teach us about creative industries, what it contributes to marketplace research and decision making, and how it informs creative practice. Ethnography uses participant/observation and other methods of collecting qualitative data to research specific social groups and their cultures. Asks for what purposes ethnographic methods are best suited and how ethnography might contribute to cross-cultural understanding, arts leadership, and creative practice. Covers what unique methodological issues ethnographic research in the arts might pose. Offers students an opportunity to develop and practice their own research skills, designing and conducting self-defined ethnographic research.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Societies/Institutions, NUpath Writing Intensive

**MUSC 3410. Recital 1. (1 Hour)**

Offers preparation for and performance of a minirecital (twenty to thirty minutes of music) under the guidance of the student's primary instrumental or vocal instructor. Minirecitals are usually shared by more than one student.

**MUSC 3541. Music Analysis Seminar. (4 Hours)**

Exposes students to advanced methods of musical analysis. Focuses on techniques for analyzing large musical forms from the baroque period to the present day.

**Prerequisite(s):** MUSC 1202 with a minimum grade of C

**MUSC 3973. Special Topics in Music. (4 Hours)**

Focuses on various topics related to music. May be repeated twice for a maximum of 12 semester hours.

**MUSC 3983. Special Topics in Music Analysis. (4 Hours)**

Focuses on advanced topics in theory and analysis. Topics vary with each offering. May be repeated twice for a maximum of 12 semester hours.

**MUSC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUSC 4510. Music and the Brain Research. (4 Hours)**

Offers an overview of the perceptual, cognitive, and neural bases of performing, composing, and listening to music. Topics include acoustics and biological processing of sound; theories and empirical research on pitch, rhythm, harmony, melody, timbre, orchestration; similarities and differences between music and language; evolution and development of musical ability; and special populations in musical functions. Meetings include laboratory demonstrations and exercises in experiment design and data analysis. Requires a final project (paper and in-class presentation).

**Prerequisite(s):** MUSC 2350 with a minimum grade of C or MUSC 3300 with a minimum grade of C or PSYC 2320 with a minimum grade of C

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Capstone Experience, NUpath Natural/Designed World

**MUSC 4622. Recital 2. (1 Hour)**

Offers preparation for and performance of a senior recital (40 to 60 minutes of music) under the guidance of the student's primary instrumental or vocal instructor.

**Prerequisite(s):** MUSC 3410 with a minimum grade of C

**MUSC 4651. Music Research Capstone. (4 Hours)**

Offers students an opportunity to complete an original research-based project on a musical topic. Organized around a shared theme such as music and entertainment, music and globalization, or music and creativity. Includes seminar-style discussions of readings that introduce students to the state of knowledge on the theme, in addition to a range of research methods and conceptual frameworks. Guides students through the research process from the formulation of questions through finding and interpreting sources, developing arguments, and crafting the presentation of results in oral and written form. Students also have the opportunity to integrate research with multimedia, performance, and/or other creative components.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**MUSC 4970. Junior/Senior Honors Project 1. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**MUSC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUSC 4992. Directed Study. (1-4 Hours)**

Focuses on independent work in a selected area of music under the direction of a member of the department. Enrollment is limited to qualified students by special arrangement with the supervising faculty member and with the approval of the department chair. May be repeated without limit.

**MUSC 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated twice.

**Attribute(s):** NUpath Integration Experience

**MUSC 5973. Special Topics in Music. (3,4 Hours)**

Focuses on various topics related to music. May be repeated twice for a maximum of 12 total semester hours.

**MUSC 6300. Music Perception and Cognition Research. (4 Hours)**

Offers an overview of the perceptual, cognitive, and brain bases of performing, composing, and listening to music for enjoyment and for human benefit. Studies how and why music stimulates our senses and how it can promote health and well-being. Topics include theories and empirical research on pitch, rhythm, harmony, melody, timbre; music and language; development of musical ability; and special populations in musical functions. Meetings include demonstrations and exercises in experiment design and data analysis. Requires an in-depth research project (paper and in-class presentation), in consultation with the instructor. By the end of this course, students should be able to design and conduct their own research study in music perception and cognition.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**MUSC 6510. Music and the Brain Advanced Research. (4 Hours)**

Reviews contemporary studies in cognitive neuroscience of music, specifically in speech, language, and music. Offers students an opportunity to obtain in-depth training on the methods of cognitive neuroscience of music. Students design and implement a group project, analyze the data, and write up the results in an end-of-term paper.

**Music - CPS (MUS)****MUS 1100. Sound Health: Music and Relaxation. (3 Hours)**

Offers students an opportunity to gain a heightened awareness of the power of music to effect physical and emotional change and to examine the effects of music on the body, mind, and spirit. Explores awareness of sound and the physiological changes caused by music. Covers sound pollution, the effects of vibrations on the body, guided imagery, and music and meditation.

**MUS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUS 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**MUS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Music Industry (MUSI)****MUSI 1230. Introduction to Music Industry. (4 Hours)**

Examines business-related areas of the music industry. Topics include music publishing, copyright, the function of performing rights organizations (ASCAP and BMI), talent agents, artist management, concert promotion, and royalties and contracts.

**MUSI 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUSI 2101. Demo Production for Songwriters. (4 Hours)**

Offers students an opportunity to learn the necessary techniques to utilize current Musical Instrument Digital Interface (MIDI) and audio technology in the production of professional-quality song demos, including intermediate to advanced skills and concepts of MIDI, synthesis, multitrack recording, mixing, and sound processing. Covers musical approaches to the effective assembly and arranging of sound materials using professional digital audio workstations (DAWs). Focuses on techniques to import and export both MIDI and audio data to greater facilitate collaboration within the virtual classroom as well as using external collaborators (across a variety of DAWs and platforms). Songwriting skills are also critiqued.

**Attribute(s):** NUpath Creative Express/Innov

**MUSI 2231. Music Licensing for Media. (4 Hours)**

Examines a variety of music usages in film, advertisements, TV shows, and other media types or venues that require music licensing. Offers students an opportunity to examine licenses and agreements in an effort to enable them to customize boilerplate forms to reflect accurately the needed licenses with any and all customized terms. Stresses teamwork, defining roles within a team, and assertiveness in an effort to enable students to function at their highest level for the demanding team-based final project. The final project stresses resourcefulness, meeting deadlines, creative excellence, along with open and sustained communication between the production side and the creative side.

**Prerequisite(s):** MUSI 1230 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**MUSI 2232. Music Production and Recording 1. (4 Hours)**

Introduces the modern commercial and popular music production process including music creation, editing, arrangement, and mixing. Emphasizes core techniques in operating industry-standard music production software, critical listening for assessment purposes, and mixing and editing audio. No prior production experience is required. Weekly practical assignments culminate in a final music production project, for which students may use their own creative work.

**MUSI 2234. Festivals. (4 Hours)**

Examines the multiple ways in which festivals affect musical life. Analyzes festivals both as music communities concentrated into limited temporal and geographic frames as well as social and cultural institutions situated within particular historical and cultural contexts. Studies what a festival does; what we can learn from the history of music festivals; how festivals have impacted social, cultural, economic, and aesthetic hierarchies; and what festival organizers consider when making artistic, financial, and administrative decisions. By the end of the semester, successful students should have a comprehensive understanding of both the business and the cultural contexts of music festivals, which they should be able to demonstrate through individual written, multimodal creative, and group assignments.

**Attribute(s):** NUpath Creative Express/Innov

**MUSI 2235. Copyright in the Creative Industries. (4 Hours)**

Explores the balance of interests at the heart of copyright law, including enhancing the public interest, supporting innovation, and protecting private property rights. Offers students an opportunity to gain an appreciation of the significance of copyright in the structure, operation, and customs of the creative industries. Focuses on the unique character of music-related copyright issues and addresses the music industries' outsized impact on the development of copyright policy in the United States.

**Attribute(s):** NUpath Societies/Institutions

**MUSI 2330. Performing Arts Administration. (4 Hours)**

Introduces music management including the structure of nonprofit organizations (such as arts service organizations, arts centers, symphony orchestras, chamber orchestras, ensembles, opera companies, and university arts programs) and the structure of for-profit enterprises. Examines financial management, funding, and audience development.

**MUSI 2331. Music Production and Recording 2. (4 Hours)**

Explores modern commercial and popular music production processes including workflows, production chronology, and microphone techniques. Emphasizes intermediate techniques in operating industry-standard music production software and critical listening for assessment purposes. Weekly practical assignments augment a course-long production project.

**Prerequisite(s):** MUSI 2232 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**MUSI 2332. Music Publishing and Royalties. (4 Hours)**

Focuses on music publishing, which plays a pivotal role in the music industry. Not only does this field generate billions of dollars worldwide in revenue, but it has become an essential part of the recording, live performance, and merchandising sectors of the music industry. Examines the concepts and current issues of music publishing as it pertains to recording, film, television, print, and other media. Topics include licensing, royalty collection, and the art of negotiating music copyrights.

**Prerequisite(s):** MUSI 1230 with a minimum grade of C

**MUSI 2341. Music Supervision 1. (4 Hours)**

Covers the field of music supervision, which has become an in-demand field due to the increased use of songs in TV shows, films, live events, advertisements, websites, and other forums. Discusses the whole process, from choosing the perfect song/lyric to strategies for securing licensing with artists and publishers. Offers students a hands-on opportunity to make music selections fit a variety of media and also to structure licensing/contract deals for composers, publishers, and record companies. Final project involves networking with Green Line Records and external rights holders to license and place music into a series of scenes and advertisements.

**Prerequisite(s):** MUSI 1230 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**MUSI 2973. Special Topics in Music Industry. (1-4 Hours)**

Focuses on various topics related to the music industry. May be repeated twice for up to 12 total semester hours.

**Prerequisite(s):** MUSI 1230 with a minimum grade of C

**MUSI 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUSI 2991. Research in Music Industry. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision.

**MUSI 3210. Music Tourism. (4 Hours)**

Considers how stakeholders in a variety of roles (government, NGO, private industry, local communities, etc.) balance the interests of music tourism. Addressing the socioeconomic incentives and broader cultural and environmental impacts, discusses specific examples of local and regional organizations that promote music festivals, concerts, nightlife, and heritage events as tourist destinations. Introduces public policy recommendations as key interventions regarding the opportunities and costs of sustainable, community-engaged music tourism.

**Prerequisite(s):** MUSC 1001 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**MUSI 3332. Artist Management. (4 Hours)**

Provides an in-depth investigation of the field of musical artist management. Explores the artist-manager relationship, the management contract, artist evaluation, image formulation, the artist's development team, achieving a recording contract, merchandising, endorsements, sponsorships, touring, and financial management.

**Prerequisite(s):** MUSI 1230 with a minimum grade of C

**MUSI 3333. The Record Industry. (4 Hours)**

Examines the domestic and international record industry. Topics include industry structure, business and legal affairs, the recording contract, royalties, manufacturing, distribution, promotion, publicity, advertising, licensing, and piracy. Offers students the opportunity to explore major record labels and independent labels. Addresses the past, present, and future.

**Prerequisite(s):** MUSI 1230 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov

**MUSI 3338. Music Industry Marketing and Promotion. (4 Hours)**

Provides a thorough examination of the principles and applications of marketing and promotion within the music industry. Students explore how music companies successfully conduct product, pricing, distribution, and communication management. Approaches music marketing issues using readings, specific music marketing case studies, lectures, guest speakers, and projects.

**Prerequisite(s):** MUSI 1230 with a minimum grade of C

**MUSI 3340. Concert Promotion and Venue Management. (4 Hours)**

Provides an in-depth exploration of the principles and practices of concert promotion and venue management. Focuses on areas such as concert promotion, venue advertising, talent buying, contractual requirements, insurance, government regulation, American Society of Composers, Authors, and Publishers (ASCAP)/BMI licenses, personnel management, and concert production and administration.

**Prerequisite(s):** MUSI 1230 with a minimum grade of C

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Creative Express/Innov

**MUSI 3341. Music Production and Recording 3. (4 Hours)**

Focuses on the final stages of the modern commercial and popular music production process: mixing and mastering. Emphasizes advanced techniques in operating industry-standard music production software and advanced critical listening for making decisions about levels, equalization, dynamics, time-based effects, and spatial positioning when mixing and mastering. Weekly practical assignments in listening and analysis are designed to augment hands-on practice using both students' current productions and current professional music productions.

**Prerequisite(s):** MUSI 2331 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**MUSI 3351. Music and Social Justice. (4 Hours)**

Introduces theories of ethics, morality, and equality and strategies to advance social justice—to ensure equality and human dignity for all people—through music. Explores the music industry as both a microcosm of society and amplifier of our collective ethics. On stage, on the record, and through direct action, musicians worldwide use their art and renown to serve social movements. Many also face equality and equity challenges within the music industry. As future professionals, students may either challenge or reinforce the injustices they encounter in their professional and personal lives. Through critical discourse on professional ethics in the music business and service-learning projects requiring direct community engagement, seeks to empower students to make a lifelong commitment to ethical decision making and advancing social justice.

**Attribute(s):** NUpath Difference/Diversity, NUpath Ethical Reasoning

**MUSI 3360. Global Music Industries in Context. (4 Hours)**

Offers students an opportunity to obtain the cultural curiosity and adaptive dexterity needed to analyze diverse global music industries in their historical, cultural, economic, and political contexts. Through the labels, scenes, and digital spaces that form the professional settings for today's global music professionals—explored in course readings, creative case studies, and summative research projects—identifies the many ways in which diverse industries consolidate music production, distribution, and consumption. Students encounter and analyze diverse professional practices and creative products and critique music's value—financial, social, political, ideological, and personal. In addition, students practice critical reading and observation and identify traditions within the social sciences and cultural criticism that provide valuable theoretical lenses for the interpretation of global music industries in context.

**Prerequisite(s):** MUSI 1230 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions, NUpath Writing Intensive

**MUSI 3401. Hip Hop in the Music Industry. (4 Hours)**

Focuses on black popular music as art, activism, and commodity from the post–Civil Rights era to today. Studies the immediate musical, historical, cultural, and industry-based precedents for rap music, which emerged in opposition to the music industry—and many other institutions that perpetuated the inequalities against which early hip-hop artists were protesting. The contemporary moment provides a unique opportunity for refocusing on the origins of hip-hop and black protest music as they relate to the industry's embrace and commodification of certain aspects of hip-hop culture. Explores the dynamic tensions between rap music as aesthetic object, countercultural expression, social commentary, and industry commodity, engaging with current expressions of all of these in the Boston area.

**Prerequisite(s):** ENGW 1111 with a minimum grade of D-

**MUSI 3973. Special Topics in Music Industry. (4 Hours)**

Focuses on various topics related to the music industry. May be repeated twice for up to 12 semester hours.

**MUSI 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUSI 4530. Music Entrepreneurship. (4 Hours)**

Designed to provide students with the knowledge, skills, and abilities necessary to plan, finance, develop, and operate a new music venture. Topics include attributes of music entrepreneurs and entrepreneurial careers, evaluating opportunities, writing business plans, financing the venture, and long-term management and planning.

**Prerequisite(s):** MUSI 1230 with a minimum grade of C ; (ACCT 1201 with a minimum grade of D- or ACCT 1209 with a minimum grade of D- ); ECON 1116 with a minimum grade of D-

**MUSI 4601. Seminar in Music Industry. (4 Hours)**

Presents a capstone course for music industry students. Offers advanced students the opportunity to explore contemporary events and issues in the music industry. Allows students to reflect upon, distill, and apply knowledge accumulated in prior courses and previous experiential learning. This reflection and application occurs through substantial writing assignments and classroom discussion. Fulfills the college's experiential education requirement for music industry majors.

**Prerequisite(s):** MUSI 1230 with a minimum grade of C

**Attribute(s):** NUpath Capstone Experience, NUpath Societies/Institutions, NUpath Writing Intensive

**MUSI 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUSI 4992. Directed Study. (1-4 Hours)**

Focuses on independent work in a selected area of music under the direction of a member of the department. Enrollment is limited to qualified students by special arrangement with the supervising faculty member and with the approval of the department chair. May be repeated without limit.

**MUSI 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated twice.

**Attribute(s):** NUpath Integration Experience

**MUSI 5220. The Independent Performing Songwriter: Creation, Commerce, and Well-Being. (4 Hours)**

Explores the evolving terrain of the independent music industry for songwriters who write, perform, and release music independently. Examines songwriting, production, performance, and how to navigate the digital music landscape effectively. Covers the business side of music including rights, royalties, and branding strategies. Studies best practices to manage one's own career. Emphasizes the artist's well-being, exploring mindfulness, time management, and resilience to maintain a sustainable and fulfilling career. Offers students an opportunity to enhance artistic skills and obtain a holistic understanding of the music industry.

**Attribute(s):** NUpath Creative Express/Innov

**MUSI 5330. Actionable Analytics in the Music Industries. (4 Hours)**

Covers the analytical frameworks and tools to obtain, evaluate, analyze, interpret, and visualize data from the music industries. Explores the metrics most often used in Artists and Repertoire, concert booking and promotion, streaming music and video, paid and organic social media, music publishing, brand partnerships, and the independent artist journey. Addresses data analysis tools and data aggregation platforms, whose capabilities enable the creation of visualizations and data-informed narratives that support decision-making processes to achieve specific artist, professional, and organizational objectives and outcomes.

**Attribute(s):** NUpath Analyzing/Using Data

**MUSI 5973. Special Topics in Music Industry. (3,4 Hours)**

Focuses on various topics related to the music industry. May be repeated up to two times for up to 12 total credits.

**MUSI 6964. Co-op Work Experience. (0 Hours)**

Offers eligible students an opportunity for work experience.

**MUSI 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

**MUSI 7980. Capstone. (4 Hours)**

Offers students an opportunity to integrate their course work, knowledge, and experiences into a capstone project. Offers students an opportunity to work in partnership with local, state, or national leaders to produce an operational music company. This is a faculty-guided project for students completing course work in music industry leadership studies.

**Music Technology (MUST)****MUST 1220. Introduction to Music Technology. (4 Hours)**

Offers students an opportunity to obtain foundational concepts and skills in music technology, audio research, and music production. Topics include the physics of sound, acoustics, and psychoacoustics to understand sound fundamentals; signal processing, sound synthesis, and analysis to explore audio technologies; practical applications using audio editors, digital audio workstations, and MIDI in music production; and basic electronics related to audio equipment.

**Attribute(s):** NUpath Analyzing/Using Data

**MUST 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUST 2102. Composing with Digital Technologies. (4 Hours)**

Offers students an opportunity to create compositions using a digital audio workstation (DAW) as the principal tool. Standard Western music notation may be used in examples of certain techniques but will not be necessary for the creation of work in the course. Explores various composition topics such as periodicity, form, texture, timbre, and contour in the digital domain. Consists of a number of short composition and listening assignments culminating in the creation of compositions of moderate duration.

**Prerequisite(s):** MUST 1220 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**MUST 2320. Sound Design. (4 Hours)**

Instructs students in the art of producing and designing musical accompaniments for a variety of media including film, TV commercials, industrial video, animation, games, theatre, and radio drama. Focuses on abstract thinking regarding sound theory and practice and includes hands-on skills. Restricted to music majors and combined majors; all other students require permission of instructor.

**Attribute(s):** NUpath Creative Express/Innov

**MUST 2431. Computer Music Fundamentals. (4 Hours)**

Focuses on the creation and implementation of standard time-domain audio synthesis routines and effects, as well as standard frequency-domain processing routines. MaxMSP is the principal programming environment used in the course. Begins with programming protocols, as well as data structures and storage, and list processing in the MaxMSP environment before moving on to standard synthesis and audio processing routines. Examines how the techniques learned in the course can be applied using a variety of synthesis and spectral processing software applications that are standard in the field.

**Prerequisite(s):** MUST 1220 with a minimum grade of C

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**MUST 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUST 3300. Musical Interactions in Extended Reality. (4 Hours)**

Explores the immersive world of extended reality—a general term that includes augmented reality, virtual reality, and mixed reality—with a specialized focus on musical interactions. Offers students an opportunity to gain the skills and knowledge to leverage XR software and hardware for the design of interactive musical applications. Introduces scripting, sensing, and interaction paradigms tailored for XR, with a unique lens on the integration of musical elements including sampling, real-time synthesis and processing, 3D/spatialized audio, as well as musical performance.

**Prerequisite(s):** MUST 2431 with a minimum grade of C

**Attribute(s):** NUpath Formal/Quant Reasoning, NUpath Natural/Designed World

**MUST 3601. Digital Audio Signal Processing. (4 Hours)**

Introduces students to digital signal processing as it relates to offline or non-real-time audio processing. Covers fundamental engineering concepts and mathematics. Examines implementation details of common digital audio processing routines using the C programming language, the industry standard for audio software engineering.

**Prerequisite(s):** MUST 2431 with a minimum grade of C

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**MUST 3602. Electronics for Music. (4 Hours)**

Introduces analog electronics in the context of audio synthesis and processing. Covers the basics of electronics and analog audio signals; passive components, transistors, operational amplifiers, and sensors; analog audio synthesis, filters, amplification, and modulation; and design standards for analog audio equipment. In-class activities revolve around designing, building, analyzing, and testing sound-emitting circuits.

**Prerequisite(s):** MUST 2431 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Natural/Designed World

**MUST 3603. Embedded Audio Programming. (4 Hours)**

Explores the use of embedded computers for designing interactive audio applications. Begins with a programming primer and transitions to programming audio applications using an industry standard language, focusing on transferring skills acquired in visual programming environments to embedded/low-level programming concepts. Key topics include low-latency real-time audio synthesis and processing, physical computing, sensor integration, and basic electronics. Offers students an opportunity to gain experience across the full cycle of design, development, and testing of interactive software and hardware technologies for audio applications.

**Prerequisite(s):** MUST 2431 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Natural/Designed World

**MUST 3973. Special Topics in Music Technology. (1-4 Hours)**

Focuses on topics related to current trends in the area of music technology. Topics vary with each offering. May be repeated up to two times for up to 12 total credits.

**Prerequisite(s):** MUST 1220 with a minimum grade of C

**MUST 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUST 4600. Digital Audio Signal Analysis. (4 Hours)**

Presents the programmatic analysis of digital audio signals in both the time and frequency domains. Begins with low-level feature extraction, such as amplitude envelope and spectral centroid. Progresses to higher-level music information retrieval systems such as onset detection, tempo, and pitch estimation. Covers common engineering concepts and mathematics using an industry-standard programming language for audio software engineering.

**Prerequisite(s):** MUST 3601 with a minimum grade of C or MUST 3603 with a minimum grade of C

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**MUST 4610. Composition for Electronic Instruments. (4 Hours)**

Instructs students in the composition of original music for electronic and computer-based instrumentation. Students create music to accompany video, animation, and film, and study suitable methods for creating original music for the Internet. Also surveys examples of music written for similar contexts.

**Prerequisite(s):** MUST 2431 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**MUST 4611. Music Technology Capstone. (4 Hours)**

Guides students in the research, preparation, and presentation of their own work in music technology. Projects may include music compositions, multimedia pieces, novel software or hardware tools for composition/performance, interactive sound installations, or other projects that bridge students' cumulative educational careers with future professional pathways. Offers students an opportunity to present their work to a public audience in an on-campus interdisciplinary event at the end of the semester.

**Prerequisite(s):** MUSC 4510 with a minimum grade of C or MUST 3300 with a minimum grade of C or MUST 3601 with a minimum grade of C or MUST 3602 with a minimum grade of C or MUST 3603 with a minimum grade of C or MUST 3973 with a minimum grade of C or MUST 4610 with a minimum grade of C or MUST 5973 with a minimum grade of C

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**MUST 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**MUST 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated twice.

**Attribute(s):** NUpath Integration Experience

**MUST 5510. Sound, Motion, and Computer Interaction. (4 Hours)**

Introduces methods for detecting human movement in video data using a high-level computer programming language. Focuses on the development of interactive computer music applications for video. Presents methods for programming discrete functions to acquire and process sound and movement data. Emphasizes the process of sequencing and integrating discrete functions to develop movement-responsive computer programs that transform sound and action into quantitative signals, artistic media, and aesthetic experiences.

**Prerequisite(s):** MUST 2431 with a minimum grade of C or graduate program admission

**MUST 5973. Special Topics in Music Technology. (3,4 Hours)**

Focuses on various topics related to music technology. May be repeated up to two times for up to 12 total credits.

**MUST 6603. Embedded Programming for Digital Musical Instruments. (4 Hours)**

Explores embedded computers and their employment for the design of digital musical instruments. Studies how to program low-level audio applications that take advantage of the responsiveness and the interactive features of embedded systems. Starts with an overview of high-level embedded audio programming; then transitions into a deep exploration of low-level C++ programming techniques, specific for the design of digital musical instruments. Primarily covers low-latency real-time audio synthesis/processing, yet includes an in-depth introduction to physical computing, sensors, and simple electronics. Offers students an opportunity to gain experience with the full design-development-test cycle of software and hardware components of digital musical instruments within the confines of a final project. Requires knowledge of audio and programming.

**Nanomedicine (NNMD)****NNMD 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated twice.

**Attribute(s):** NUpath Integration Experience

**NNMD 5270. Foundations in Nanomedicine: Therapeutics. (3 Hours)**

Offers an interdisciplinary, state-of-the-art introduction to nanotechnology-based therapeutics. Covers the foundations of nanoparticle synthesis, characterization, scale-up, translation, and regulatory approval. Discusses disease-specific considerations for in vivo transport, targeting, and drug delivery. Offers students an opportunity to blog about enabling innovations in nanomedicine related to a disease of their choice. Features weekly case studies presented by Northeastern faculty and guest experts from academia, hospitals, and industry.

**Attribute(s):** NUpath Natural/Designed World, NUpath Writing Intensive

**NNMD 5271. Foundations in Nanomedicine: Diagnostics. (3 Hours)**

Offers an interdisciplinary, state-of-the-art introduction to nanotechnology-based diagnostics. Covers the foundations of in vitro diagnostics and in vivo imaging, including considerations for designing diagnostic tests, device research and development, innovation vs. invention, contrast agents, companion diagnostics, medical device regulation, device reporting requirements, and challenges unique to devices for global health. Highlights examples of diagnostic technologies currently in clinical trials through talks by Northeastern faculty and guest experts from academia, hospitals, and industry.

**NNMD 5272. Nanomedicine Seminar. (1 Hour)**

Presents examples of research and innovation in the field of nanomedicine, with a focus on emerging technologies to solve pressing problems in human health. Features both medical case studies and rotating talks from experts in hospitals, government, academia, and industry. Offers students opportunities to practice scientific and professional skills through interactive nanomedicine activities. This course may be repeated up to three times for credit.

**NNMD 5310. Bioethics in the Age of Artificial Intelligence. (1 Hour)**

Discusses forward-looking case studies centered on emerging technologies for healthcare and medical decision making. Draws on examples from nanomedicine, bioinformatics, and artificial intelligence to highlight the importance of developing technological innovations in a safe, responsible, equitable, and bias-free manner. Offers students an opportunity to define/refine their own ethical standards, develop ethical reasoning skills, and practice identifying evidence-based solutions for evolving ethical challenges in the laboratory, co-op, and workplace.

**NNMD 5370. Nanomedicine Research Techniques. (4 Hours)**

Presents an in-depth look at the theory, methods, and instrumentation for studying nanomaterials used in biology and medicine. Students explore research theory using interactive online modules, read detailed protocols, watch laboratory demonstrations, practice interactive laboratory simulations, and analyze student-generated data. Offers students an opportunity to experience a wide range of laboratory techniques including nanoparticle synthesis, electron microscopy, optical microscopy, magnetic resonance imaging, high-performance liquid chromatography, in vitro measurements of bioactivity and cytotoxicity, and in vivo measurements of treatment efficacy.

**NNMD 5380. Electron Microscopy Techniques. (4 Hours)**

Offers an in-depth look at scanning and transmission electron microscopy techniques for materials characterization at the nanoscale in science, engineering, and medicine applications. Provides fundamental theory as well as comprehensive hands-on lab experience in imaging, diffraction, and spectroscopy. Studies both organic and inorganic specimen preparation including block face sectioning, fixation, and sputter coating.

**NNMD 5470. Nano/Biomedical Commercialization: Concept to Market. (3 Hours)**

Offers a comprehensive overview of the commercialization process for nano- and biomedical technologies. Discusses the key elements of a successful business plan, including scientific innovation, market assessment, customer discovery, intellectual property protection, business modeling, and value extraction. Also covers regulatory processes and market-specific strategies for raising capital. Offers students an opportunity to gain entrepreneurship skills through the creation of a team business proposal. Students have opportunities to interact with guest entrepreneurs.

**Attribute(s):** NUpath Creative Express/Innov

**NNMD 5570. Preclinical and Clinical Study Design. (3 Hours)**

Offers an in-depth look at preclinical and clinical considerations for drug discovery and development. Emphasizes identifying and addressing challenges associated with animal models, evaluation of drug-tissue interactions, qualifying for good laboratory practices, clinical trial design, patient stratification, and clinical trial management. Identifies key terminology and statistical considerations used in preclinical and clinical settings. Students practice steps of preclinical and clinical translation through a combination of case studies, data analysis, discussions, and a team project.

**NNMD 6272. Professional Nanomedicine Seminar. (0 Hours)**

Presents examples of research and innovation in the field of nanomedicine, with a focus on emerging technologies to solve pressing problems in human health. Features both medical case studies and rotating talks from experts in hospitals, government, academia, and industry. Offers students opportunities to practice scientific and professional skills through interactive nanomedicine activities. May be repeated up to three times.

**NNMD 6370. Nanomedicine Experiential Capstone. (4 Hours)**

Offers hands-on experience in the design, synthesis, and optimization of a nanoparticle using high-throughput microfluidics. Students work in teams to rationally design and synthesize a therapeutic nanoparticle, as well as develop and implement in vitro nanocharacterization protocols. Involves iterative collection, analysis, and interpretation of laboratory data to optimize nanoparticle synthesis.

**Prerequisite(s):** NNMD 5370 (may be taken concurrently) with a minimum grade of B

**NNMD 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**NNMD 6984. Independent Research. (1-4 Hours)**

Offers an opportunity to conduct independent research under faculty supervision. May be repeated once.

**NNMD 7500. Reflection Capstone. (0 Hours)**

Offers students an opportunity to reflect on and integrate new knowledge and skills acquired in course-based, research-based, and co-op-based experiential learning. Enhances the learning outcomes of prior and ongoing real-world experiences through engagement in self-reflection activities centered around growth of professional skills and competencies, professional identity, and positionality in relation to the profession students are preparing to enter. Presents a reflective practice toolkit designed to empower students to develop an actionable plan for lifelong learning and personal growth.

**Prerequisite(s):** EESC 6500 with a minimum grade of B ; NNMD 5270 with a minimum grade of B ; NNMD 5271 with a minimum grade of B

**Network Science (NETS)****NETS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**NETS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**NETS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**NETS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**NETS 5116. Network Science 1. (4 Hours)**

Introduces network science and the set of analytical, numerical, and modeling tools used to understand complex networks emerging in nature and technology. Focuses on the empirical study of real networks, with examples coming from biology (metabolic, protein interaction networks), computer science (World Wide Web, Internet), or social systems (e-mail, friendship networks). Shows the organizing principles that govern the emergence of networks and the set of tools necessary to characterize and model them. Covers elements of graph theory, statistical physics, biology, and social science as they pertain to the understanding of complex systems.

**Prerequisite(s):** PHYS 2303 with a minimum grade of D- or graduate program admission

**Attribute(s):** NUpath Natural/Designed World

**NETS 6108. Complex Network Analysis Capstone. (2 Hours)**

Offers students an opportunity to apply network analytic tools and network science concepts to a project that further develops skills and expands understanding of how to approach problems using network analytics and principles. Students may propose a topic or choose projects presented by a sponsoring organization or agency. Topics must be approved by the instructor, and students are expected to provide regular updates and present their final project. May be repeated once.

**Prerequisite(s):** INSH 5301 with a minimum grade of C ; NETS 5001 with a minimum grade of C ; NETS 5002 with a minimum grade of C ; NETS 5103 with a minimum grade of C

**NETS 6116. Network Science 2. (4 Hours)**

Continues an exploration of network science and the set of analytical, numerical, and modeling tools used to understand complex networks emerging in nature and technology. Focuses on the empirical study of real networks. Investigates the organizing principles that govern the emergence of networks and the set of tools necessary to characterize and model them. Offers students an opportunity to obtain a deeper understanding of complex systems.

**Prerequisite(s):** PHYS 5116 with a minimum grade of C or NETS 5116 with a minimum grade of C

**NETS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**NETS 7332. Machine Learning with Graphs. (4 Hours)**

Covers a number of advanced topics in machine learning and data mining on graphs, including vertex classification, graph clustering, link prediction and analysis, graph distance functions, graph embedding and representation learning, deep learning for graphs, anomaly detection, graph summarization, network inference, adversarial learning on networks, and notions of fairness in social networks. Seeks to familiarize students with state-of-the-art descriptive and predictive algorithms on graphs. Requires a foundational understanding of calculus and linear algebra, probability, machine learning or data mining, algorithms, and programming skills.

**Prerequisite(s):** PHYS 5116 with a minimum grade of C

**NETS 7334. Social Networks. (4 Hours)**

Offers an overview of the literature on social networks, with literature from political science, sociology, economics, and physics. Analyzes the underlying topology of networks and how we visualize and analyze network data. Key topics include small-world literature and the spread of information and disease. Students who do not meet course prerequisites may seek permission of instructor.

**NETS 7335. Dynamical Processes in Complex Networks. (4 Hours)**

Immerses students in the modeling of dynamical processes (contagion, diffusion, routing, consensus formation, etc.) in complex networks. Includes guest lectures from local and national experts working in process modeling on networks. Dynamical processes in complex networks provide a rationale for understanding the emerging tipping points and nonlinear properties that often underpin the most interesting characteristics of sociotechnical systems. Reviews the recent progress in modeling dynamical processes that integrates the complex features and heterogeneities of real-world systems.

**Prerequisite(s):** NETS 5116 with a minimum grade of C- or PHYS 5116 with a minimum grade of C-

**NETS 7341. Network Economics. (4 Hours)**

Covers seminal works in the economics of information and networks, including Akerlof, Arrow, Spence, Stiglitz, and von Hayek. Proceeds through concepts of information, its value, and measurement; search and choice under uncertainty; signaling, screening, and how rational actors use information for private advantage; strategy-given network effects; two-sided (or multisided) network effects, organizational information processing, learning, and social networks; and other micro- and macroeconomic effects such as matching markets. Although primarily a theory course, it may be of interest to any student applying information economics and network economics in academic, commercial, or government policy contexts. Expects students to produce a major paper suitable for publication or inclusion in a thesis. Requires prior completion of graduate coursework in microeconomics and mathematics at the level of introductory calculus and statistics.

**NETS 7350. Bayesian and Network Statistics. (4 Hours)**

Introduces advanced quantitative methods including maximum likelihood, hierarchical models, sampling, and network modeling. Offers students an opportunity to engage in estimating and developing models from the probabilistic and Bayesian perspective and to pursue their own research project, focusing on methodological challenges. Reviews probability and examines maximum likelihood methods for estimating regression models with continuous and categorical dependent variables. Examines a variety of procedures for sampling from posterior distributions including grid, quadratic, Gibbs, and Metropolis sampling. Applies these methods to hierarchical modeling and other simple probabilistic models and then takes a closer look at the statistical modeling of networks as it has been developed in the social sciences (e.g., exponential random graph models, temporal models such as TERGM and SIENA, spatial network models, and stochastic block models).

**NETS 7360. Research Design for Social Networks. (4 Hours)**

Analyzes the architecture of research—how to design ethical research projects that empower the researcher to make useful and interesting claims about the world. Topics include design research about social networks and how to measure such varied relational concepts such as friendship, love, and proximity; the effective study of "recycled" data—data not collected for research—such as Twitter, cell phone, or email data, and the ethical constraints in using this data; and how to design data collection so as to make robust causal claims.

**NETS 7370. Computational Urban Science. (4 Hours)**

Introduces the field of computational urban science, focusing on methods to collect and analyze urban data. Covers techniques such as geographic information systems, network science, machine learning, spatial models, and causal inference to examine city dynamics and inform urban planning, policy, and research. Explores the application of these methods to real-world urban datasets, including mobile phone data, social media, and transactional data, enabling critical insights into the complexities of urban systems.

**Prerequisite(s):** INSH 5301 with a minimum grade of B or NETS 5116 with a minimum grade of B or PHYS 5116 with a minimum grade of B

**NETS 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of a member of the program on a chosen topic. Course content depends on instructor. May be repeated without limit.

**NETS 7983. Topics. (4 Hours)**

Covers various topics in network science. May be repeated up to two times for up to 12 total credits.

**NETS 8941. Network Science Literature Review Seminar. (2 Hours)**

Critically evaluates recent articles in the academic literature surrounding topics and applied research in network science. May be repeated up to three times.

**NETS 8984. Research. (1-4 Hours)**

Offers advanced students an opportunity to work with an individual instructor on a topic related to current research. Instructor and student negotiate a written agreement as to what topic(s) are covered and what written or laboratory work forms the basis for the grade. Viewed as a lead-in to dissertation research. May be repeated without limit.

**NETS 8986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**NETS 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**NETS 9990. Dissertation Term 1. (0 Hours)**

Offers experimental and theoretical work for PhD candidates. Requires written dissertation and final oral exam.

**Prerequisite(s):** NETS 9000 with a minimum grade of S

**NETS 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** NETS 9990 with a minimum grade of S

**NETS 9996. Dissertation Continuation. (0 Hours)**

Offers experimental and theoretical work for PhD candidates. Requires written dissertation and final oral exam.

**Prerequisite(s):** NETS 9991 with a minimum grade of S or Dissertation Check with a score of REQ

**Nonprofit Management - CPS (NPM)****NPM 5100. Strategic Management and Leadership for Nonprofit Organizations. (2.25 Hours)**

Introduces the nature and significant trends of the nonprofit sector, both in the United States and internationally. Aims to deepen student understanding of the nonprofit world and its organizations, looking at the intersection between managerial practices, policy decisions, and leadership. Offers students an opportunity to identify and interpret critical issues and challenges of sustainability experienced by stakeholders of the nonprofit world and consider their implications for managerial practice. Discusses the role of governing boards—details the role of board legal fiduciary responsibilities, board development, and ongoing management.

**NPM 5110. Legal and Governance Issues in Nonprofit Organizations. (2.25 Hours)**

Examines the U.S. federal and state laws under which nonprofit organizations operate and considers their effect on the establishment and operation of nonprofit organizations. Offers students an opportunity to learn about incorporation and tax-exempt status, general liability, regulatory compliance/reporting, and contracts. Emphasizes the roles, responsibilities, processes, and powers of boards of directors.

**NPM 5120. Financial Reporting and Nonprofit Management Organizations. (2.25 Hours)**

Introduces the major financial management concepts and techniques required for effective management and performance assessment of nonprofit organizations. Managing one's budget well is an essential skill for the nonprofit manager because the organization's core mission cannot be served if the financial health of the organization is in jeopardy. Offers students an opportunity to learn about nonprofit accounting, the budgeting process, financial planning and reports, internal expenditure control, cash flow management, long-term financial planning, and to practice the use of financial and nonfinancial information in supporting decision making.

**NPM 5140. Grant and Report Writing. (2.25 Hours)**

Introduces grants and grant proposal writing. Knowledge of the grant writing cycle allows nonprofit professionals to use their time productively. Topics include effective research, creating a plan for the program, elements of a good proposal, components of the proposal package, and strategies for getting a proposal read by a foundation or corporation. Offers students an opportunity to research an RFP or identify a foundation, write a grant proposal, and ready it for submission to a funding source.

**NPM 6100. Strategic Management and Leadership for Nonprofit Organizations. (3 Hours)**

Introduces the nature and significant trends of the nonprofit sector, both in the United States and internationally. Aims to deepen student understanding of the nonprofit world and its organizations, looking at the intersection between managerial practices, policy decisions, and leadership. Offers students an opportunity to identify and interpret critical issues and challenges of sustainability experienced by stakeholders of the nonprofit world and consider their implications for managerial practice. Discusses the role of governing boards—details the role of board legal fiduciary responsibilities, board development, and ongoing management.

**NPM 6110. Legal and Governance Issues in Nonprofit Organizations. (3 Hours)**

Examines the U.S. federal and state laws under which nonprofit organizations operate and considers their effect on the establishment and operation of nonprofit organizations. Offers students an opportunity to learn about incorporation and tax-exempt status, general liability, regulatory compliance/reporting, and contracts. Emphasizes the roles, responsibilities, processes, and powers of boards of directors.

**NPM 6120. Financial Management for Nonprofit Organizations. (3 Hours)**

Introduces students to the major financial management concepts and techniques required for effective management of nonprofit organizations. Managing one's budget well is an essential skill for the nonprofit manager because the organization's core mission cannot be served if the financial health of the organization is in jeopardy. Offers students an opportunity to learn about nonprofit accounting, budget management, revenue forecasting, financial statements and reports, tax issues, grant compliance, internal expenditure control, audits, cash flow management, long-term financial planning, endowment management, and capital financing.

**NPM 6125. Promoting Nonprofit Organizations. (3 Hours)**

Explores the uses of traditional and nontraditional ways to promote nonprofits to an array of actual and potential audiences for a variety of purposes. All nonprofit organizations at some point must be visible to the public in order to fulfill their missions; nonprofit managers must know how to promote their organizations to current and potential supporters, the broader public, and the mass media. Topics include program and organizational branding, targeting respective audiences, and preparing materials for greatest effect.

**NPM 6130. Fundraising and Development for Organizations. (3 Hours)**

Examines sources of funding and strategies for development planning, including donor profiles, proposals and case statements, foundation and corporate philanthropy, government grant and contract programs, special events, marketing and public relations functions, direct mail and membership campaigns, planned giving, major gifts, and capital campaigns. Fundraising and development are essential skills for managers because nonprofit organizations depend upon individual, government, and foundation resources to fulfill their mission.

**NPM 6140. Grant and Report Writing. (3 Hours)**

Introduces grants and grant proposal writing. Knowledge of the grant writing cycle allows nonprofit professionals to use their time productively. Topics include effective research, creating a plan for the program, elements of a good proposal, components of the proposal package, and strategies for getting a proposal read by a foundation or corporation. Offers students an opportunity to research an RFP or identify a foundation, write a grant proposal, and ready it for submission to a funding source.

**NPM 6150. Human Resources Management in Nonprofit Organizations. (3 Hours)**

Examines methods of developing, supervising, motivating, and recognizing volunteers and staff; communicating effectively within an organization; staff-volunteer relations; and stress, conflict, and crisis management. Managers in nonprofit organizations face the challenge of working with both paid and unpaid stakeholders in the organization's future. Explores HRM topics such as legal employment issues, recruiting and hiring practices, diversity in the workplace, compensation and benefits, performance appraisal, and discipline.

**NPM 6210. Social Value Investing and Effective Partnerships. (3 Hours)**

Explores cross-sector partnerships as an effective way to build social impact and serve the greater good. Research has proven that government alone cannot address the major societal challenges; new kinds of collaboration have emerged between the public and private sectors. Leaders from nonprofit organizations are engaging in implementing new approaches that require innovation, inclusivity, shared value, and sustainable solutions. Specifically examines the reasons parties come together, the collaborative approach in which they build their agreements, and the measurement of their social impact.

**NPM 6220. Donor Research and Management. (3 Hours)**

Offers students an opportunity to obtain the tools to research new donor linkage as well as current donor interest and capacity. Seeks to increase students' understanding of donor movement, from identification through annual support, both significant and legacy giving. Examines donor engagement best practices and the importance of articulating excellent charitable gift stewardship.

**Prerequisite(s):** NPM 6100 with a minimum grade of C-

**NPM 6230. Measuring Social Impact. (3 Hours)**

Introduces students to global standards and practical tools for measuring the social impact of a nonprofit organization. Offers students an opportunity to learn how to plan and control for short-term outcomes and long-term goals and to understand how to connect the goals to quantifiable metrics that support a sustainable decision-making system. Students experience data analysis as a way to support the organization's operations and mission and ultimately create social impact.

**NPM 6240. Managing the Annual Fund. (3 Hours)**

Builds on the fundamentals of fundraising and development by focusing on the annual fund, the foundation of an integrated development program. Examines the annual cycle for generating critical operating support to fulfill the nonprofit's mission. Students have the opportunity to learn the methods for identifying new donors, cultivation strategies, solicitation methods best practices, and continued donor engagement toward repeat and increased gifts.

**NPM 6310. Social and Sustainable Entrepreneurship. (3 Hours)**

Seeks to introduce students to the meaning of social entrepreneurship. Exposes students to the social entrepreneurship term that has come to be applied to the activities of grassroots activists, NGOs, policymakers, international institutions, and corporations, among others, which addresses a range of social issues in innovative and creative ways. Offers students an opportunity to learn how to address complex sustainability challenges using experiential problem-based learning, current research, and best practices connected to social/sustainable enterprises. Topics include the design of social and sustainable enterprises, frameworks for problem solving and planning, analysis of social and environmental impact, and private-public partnerships.

**NPM 6320. New Ventures in Social Entrepreneurship. (3 Hours)**

Focuses on entrepreneurial ideas that generate social impact. Offers students an opportunity to explore social entrepreneurship and test ideas for social innovation in a rigorous and supportive environment. Covers how to generate an innovative business idea, how to address social issues and have an impact, and how to develop an action plan and consequently measure for results. Offers insights on communication, business plans, and presentation skills.

**NPM 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**NPM 6980. Capstone. (3 Hours)**

Integrates theory, practice, case studies, and experiential learning with operational and organizational concepts including, but not limited to, nonprofit law, financial management, human resource management, fund-raising and development, promotions, and grant writing. Aims to synthesize learning in a practical manner. Offers students an opportunity to prepare for working in or volunteering at a nonprofit organization. Presents an interrelationship of student learning and real-world practice through a series of pedagogical paradigms.

**Prerequisite(s):** NPM 6110 with a minimum grade of C- ; NPM 6120 with a minimum grade of C- ; NPM 6125 with a minimum grade of C- ; NPM 6130 with a minimum grade of C- ; NPM 6140 with a minimum grade of C- ; NPM 6150 with a minimum grade of C-

**NPM 6995. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Nursing (NRSG)****NRSG 1000. College: An Introduction. (1 Hour)**

Provides an introduction to the University, college, and health professions to enhance students' understanding of self and the decisions they make academically and socially as members of the University's diverse, multicultural community. Group activities and individual assignments along with active participation in a learning community help students adjust to life on an urban campus, develop a better understanding of the learning process, acquire essential academic skills, and make connections with the faculty and students in the college.

**NRSG 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**NRSG 2000. Professional Development for Co-op. (1 Hour)**

Introduces the Bouvé Cooperative Education Program. Offers students an opportunity to develop job-search and career-management skills. Students perform assessments of their workplace skills, interests, and values and discuss how they impact personal career decisions. Offers students an opportunity to prepare a professional-style résumé, learn proper interviewing techniques, and gain an understanding of the opportunities available to them for co-op. Introduces career paths, choices, and career decision making. Familiarizes students with workplace issues relative to their field of study and presents the MyNEU COOL database in the job-search and referral process. Presents and discusses co-op policies, procedures, and expectations of the Bouvé Cooperative Education Program and co-op employers.

**NRSG 2001. Foundations of Professional Nursing Practice. (2 Hours)**

Introduces students to professional nursing practice. Offers students an opportunity to envision how nurses can shape the future of the profession while developing personal strategies for success. Students explore essential tools that professional nurses employ to meet healthcare delivery challenges and begin their journey toward establishing their professional identities as caregivers, scholars, and leaders.

**NRSG 2150. Ethical Healthcare: Genetics and Genomics. (4 Hours)**

Presents an overview of bioethics and, more specifically, the application of ethics including the implication of genetics/genomics in healthcare across the life span. Students apply the Code of Ethics for Nurses to case studies that address dilemmas in multiple settings with a diverse patient population. Considers issues related to biomedical, clinical, genetic/genomic, social, and legal aspects and integrates such considerations into ethical decision making. Offers students an opportunity to work as a team and be encouraged to respect alternative viewpoints to address realistic ethical dilemmas encountered in contemporary healthcare. Appropriate and relevant for all students interested in expanding their view and appreciation of health dilemmas.

**Attribute(s):** NUpath Ethical Reasoning

**NRSG 2210. Influences on Health and Illness: A Nursing Perspective. (3 Hours)**

Offers a context within which students have an opportunity to begin to understand, develop, and nurture a professional nursing identity. Through situated learning within a model of whole-person care, the student may utilize clinical imagination and reasoning to explore culturally mediated behaviors and meanings that are ascribed to health and illness experiences across the life span. Empirical, personal, ethical, and aesthetic ways of knowing create a framework for personal reflection and reflexivity. Integrated learning strategies guide the beginner's study of communication and relationships with patients, families, and providers. Guiding course principles include foundations of the nursing profession, nursing self-care and well-being, compassionate care, social justice, and quality and safety.

**Prerequisite(s):** ((BIOL 1117 with a minimum grade of C or BIOL 2217 with a minimum grade of C); (BIOL 1121 with a minimum grade of C or BIOL 2221 with a minimum grade of C); (ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C )) or graduate program admission

**Attribute(s):** NUpath Difference/Diversity, NUpath Creative Express/Innov

**NRSG 2215. Cultivating Nursing Professional Identity and Practice. (3 Hours)**

Emphasizes cultivating a professional nursing identity to serve as the foundation for future practice. Analyzes key historical developments in nursing to understand their impact on the development of the profession and nurse-patient relationship, as well as to begin to build a framework for professional nursing practice by applying nursing theories and philosophies. Explores how theoretical contributions from fields outside of nursing can enhance nursing practice, improve quality of care, and ensure patient safety. Explores creative processes and their role in the nursing profession. Applies principles of professional nursing ethics in various care and professional situations. Offers students an opportunity to develop and implement self-care strategies, such as mindfulness practices, while designing and reflecting on an expressive artifact that fosters resilience and adaptability in the nursing field.

**Attribute(s):** NUpath Difference/Diversity

**NRSG 2220. Health Assessment and Fundamental Nursing Skills. (3 Hours)**

Introduces the concepts of wellness and caring utilizing the nursing clinical judgment model and the nursing process as the frameworks for nursing practice. Outlines the ethnic, cultural, psychosocial, and developmental gender-specific and physical aspects of health in the context of client-centered care. Offers the learner an opportunity to acquire a range of beginning assessment techniques and nursing skills that support appropriate nursing care planning and interventions for clients. Explores nurses' engagement with therapeutic communication.

**Prerequisite(s):** ((BIOL 1119 with a minimum grade of C or BIOL 2219 with a minimum grade of C); (BIOL 1121 with a minimum grade of C or BIOL 2221 with a minimum grade of C ); (CHEM 1101 with a minimum grade of C or CHEM 1161 with a minimum grade of C or CHEM 1211 with a minimum grade of C ); HSCI 1105 with a minimum grade of C ; (MATH 1215 with a minimum grade of C or MATH 1231 with a minimum grade of C or MATH 1241 with a minimum grade of C or MATH 1341 with a minimum grade of C ); (PSYC 1101 with a minimum grade of C or PSYC 1101 with a minimum grade of C )) or graduate program admission

**Corequisite(s):** NRSG 2221

**NRSG 2221. Lab for NRSG 2220 and NRSG 2222. (1 Hour)**

Applies compassionate, relationship-based care through the lenses of the nursing clinical judgment model and the nursing process. Explores the ethnic, cultural, psychosocial, developmental, gender-specific, and physical aspects of health, including social determinants that impact client outcomes. Offers students opportunities to demonstrate effective therapeutic communication, holistic health assessment techniques, and nursing skills to effectively plan care and implement patient-focused interventions. Covers how to apply empathetic and effective communication with clients and other members of the interprofessional team.

**NRSG 2222. Health Assessment and Fundamental Nursing Skills. (4 Hours)**

Introduces compassionate, relationship-based care through the lenses of the nursing clinical judgment model and the nursing process. Explores the ethnic, cultural, psychosocial, developmental, gender-specific, and physical aspects of health, including social determinants that impact patient outcomes across the life span. Offers students opportunities to explore therapeutic and interprofessional communication, define holistic health assessment techniques, and develop nursing skills for effective care planning and to prioritize client-focused interventions. Covers how to engage empathetically and effectively with clients and other members of the interprofessional team.

**Prerequisite(s):** ((BIOL 2219 with a minimum grade of C ; BIOL 2221 with a minimum grade of C ); (CHEM 1101 with a minimum grade of C or CHEM 1161 with a minimum grade of C ); (ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C ); (HSCI 1105 with a minimum grade of C ; MATH 1215 with a minimum grade of C or MATH 1241 with a minimum grade of C or MATH 1242 with a minimum grade of C or MATH 1251 with a minimum grade of C or MATH 1252 with a minimum grade of C or MATH 1341 with a minimum grade of C ); (PSYC 1101 with a minimum grade of C or PSYC 1101 with a minimum grade of C )) or graduate program admission)

**Corequisite(s):** NRSG 2221

**NRSG 2350. Integrated Pathophysiology and Pharmaceutical Interventions for Nursing Practice. (6 Hours)**

Presents the fundamentals of pharmacology and pathophysiology and serves as a foundational course for students preparing for the clinical practice settings. Focuses on the disruption of physiological processes that produce disease states and the use of drugs to prevent or ameliorate these disruptions. Discusses pathophysiologic concepts from a systems approach. Uses major medication classifications to treat common medical disorders pertaining to body systems. Presents an overview of the interprofessional team and their role as it relates to pharmacotherapeutics.

**Prerequisite(s):** ((BIOL 2219 with a minimum grade of C ; BIOL 2221 with a minimum grade of C ); (CHEM 1101 with a minimum grade of C or CHEM 1161 with a minimum grade of C or CHEM 1211 with a minimum grade of C )) or graduate program admission

**NRSG 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**NRSG 2991. Research in Nursing. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated once.

**NRSG 3120. Health Science Statistics. (4 Hours)**

Focuses on applying formal reasoning to understand the underlying principles of statistics; how to select and conduct statistical tests; and how to interpret and use the results of data analysis in relation to research questions and research hypotheses. Highlights application to clinical care.

**Prerequisite(s):** (MATH 1215 with a minimum grade of C or MATH 1241 with a minimum grade of C or MATH 1242 with a minimum grade of C or MATH 1251 with a minimum grade of C or MATH 1252 with a minimum grade of C or MATH 1341 with a minimum grade of C or MATH 1341 with a minimum grade of C ) or graduate program admission

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**NRSG 3302. Nursing with Women and Families. (3 Hours)**

Emphasizes the promotion of health for childbearing women and their families. The nursing process provides the framework for students to assess and therapeutically intervene in promoting healthy childbearing and health during the life span. Self-care and empowerment are an integral focus in examining women's health from a developmental perspective. Examines the nursing role of the professional nurse in the context of concepts of human development of individual, family, and community. Discusses the effects of cultural, social, economic, and ethical influences and the impact of healthcare technology.

**Prerequisite(s):** (NRSG 2220 (may be taken concurrently) with a minimum grade of C or NRSG 2220 (may be taken concurrently) with a minimum grade of C or NRSG 2220 (may be taken concurrently) with a minimum grade of C ); (NRSG 2221 (may be taken concurrently) with a minimum grade of C or NRSG 2221 (may be taken concurrently) with a minimum grade of C or NRSG 2221 (may be taken concurrently) with a minimum grade of C ); ((NRSG 2350 (may be taken concurrently) with a minimum grade of C or NRSG 2350 (may be taken concurrently) with a minimum grade of C ) or (NRSG 5117 (may be taken concurrently) with a minimum grade of B ; NRSG 5126 (may be taken concurrently) with a minimum grade of B )) or graduate program admission

**Corequisite(s):** NRSG 3303

**NRSG 3303. Clinical for NRSG 3302. (2 Hours)**

Emphasizes the application of theories, principles, and concepts studied in NRSG 3302 to provide nursing care with a focus on childbearing individuals and their families. Offers students an opportunity to develop specialized skills in addressing the unique healthcare needs of childbearing individuals during pregnancy, childbirth, and postpartum periods and to gain proficiency in assessments, interventions, and delivering holistic care.

**Corequisite(s):** NRSG 3302

**NRSG 3320. Nursing Care of Adults 1. (4 Hours)**

Builds on foundational knowledge from the arts, humanities, and sciences, focusing on the nursing care of clients with chronic health conditions. Offers a comprehensive and systems-based model to support person and family centered care. Emphasizes clinical decision making through collaborative practice and the use of evidence-based practices in the clinical setting. Highlights developing clinical judgment, integrating technology, and utilizing quality and safety principles. Offers students an opportunity to plan care for the client throughout the continuum of care as a means of holistic practice for the client with chronic and subacute health problems.

**Prerequisite(s):** (NRSG 2220 with a minimum grade of C or NRSG 2220 with a minimum grade of C or NRSG 2220 with a minimum grade of C or NRSG 2222 with a minimum grade of C or NRSG 2222 with a minimum grade of C or NRSG 2222 with a minimum grade of C ); (NRSG 2221 with a minimum grade of C or NRSG 2221 with a minimum grade of C or NRSG 2221 with a minimum grade of C ); (NRSG 2350 with a minimum grade of C or NRSG 2350 with a minimum grade of C or NRSG 2350 with a minimum grade of C )

**Corequisite(s):** NRSG 3321

**NRSG 3321. Clinical for NRSG 3320. (2 Hours)**

Focuses on applying the theories, principles, and concepts studied in NRSG 3320 in providing nursing care to clients and families with chronic health issues through experiential learning. Engages directly with patients, collaborates with healthcare teams, and navigates various clinical scenarios. Reinforces classroom learning.

**Corequisite(s):** NRSG 3320

**NRSG 3323. Advanced Assessment and Interventions. (1 Hour)**

Focuses on principles and concepts that support nursing assessment and the performance of advanced nursing skills in the adult patient. Health assessment, nursing interventions, and communication techniques that support clinical decision making are discussed within the nursing process framework. Emphasis is placed on critical analysis of the appropriateness of, and accurate performance of nursing interventions to ensure the provision of safe quality care. The delivery of culturally competent care and the professional development of the nurse as an inter-professional team member are discussed.

**Prerequisite(s):** ((NRSG 2220 with a minimum grade of C or NRSG 2220 with a minimum grade of C or NRSG 2220 with a minimum grade of C );

(NRSG 2221 with a minimum grade of C or NRSG 2221 with a minimum grade of C or NRSG 2221 with a minimum grade of C )); ((NRSG 2350 with a minimum grade of C or NRSG 2350 with a minimum grade of C ) or (NRSG 5117 with a minimum grade of B ; NRSG 5126 with a minimum grade of B ))

**Corequisite(s):** NRSG 3324

**NRSG 3324. Lab for NRSG 3323. (1 Hour)**

Introduces the student to the practice and application of advanced nursing skills, health assessment, and communication techniques. The course offers the opportunity to develop and master advanced assessment and intervention skills by supervised practice and demonstration. Participation in simulated patient care experiences allows the student to engage in clinical reasoning based on patient interaction and assessment that leads to the identification of appropriate nursing interventions.

**Corequisite(s):** NRSG 3323

**NRSG 3333. Comprehensive Assessment and Advanced Nursing Skills. (3 Hours)**

Focuses on principles and concepts that support nursing assessment and advanced nursing skills across the life span. Highlights health assessment, nursing interventions, and clinical reasoning in the context of patient situations. Reviews communication techniques that support client education, clinical decision making, and the development of clinical judgment. Emphasizes the delivery of safe, high-quality, and culturally competent patient-centered care and the professional development of the nurse as an interprofessional team member.

**Prerequisite(s):** (NRSG 2221 with a minimum grade of C or NRSG 2221 with a minimum grade of C or NRSG 2221 with a minimum grade of C );

(NRSG 2222 with a minimum grade of C or NRSG 2222 with a minimum grade of C or NRSG 2222 with a minimum grade of C ); (NRSG 2350 with a minimum grade of C or NRSG 2350 with a minimum grade of C or NRSG 2350 with a minimum grade of C )

**Corequisite(s):** NRSG 3334

**NRSG 3334. Lab for NRSG 3333. (1 Hour)**

Focuses on applying the theories, principles, and concepts studied in NRSG 3333 to provide evidence-based nursing care through experiential learning. Offers students an opportunity to engage directly with patients, collaborate with healthcare teams, and navigate various clinical scenarios.

**Corequisite(s):** NRSG 3333

**NRSG 3344. Nursing Care of the Childbearing Family. (2 Hours)**

Focuses on the promotion of health for childbearing individuals and their families and includes the nursing process, which provides the framework for students to make clinical judgment and therapeutically intervene in promoting healthy childbearing. Emphasizes nursing care during the perinatal period, the fetus during the pregnancy, and the infant within the family environment. Reviews how self-care and empowerment are integral in examining health from a developmental perspective. Reviews concepts of human development of the individual, family, and community for context to examine the role of the professional nurse. Discusses the impact of healthcare technology and the social determinants of health as well as biological, cultural, and ethical issues.

**Prerequisite(s):** (NRSG 3320 with a minimum grade of C or NRSG 3320 with a minimum grade of C or NRSG 3320 with a minimum grade of C );

(NRSG 3333 with a minimum grade of C or NRSG 3333 with a minimum grade of C or NRSG 3333 with a minimum grade of C ); (NRSG 3334 with a minimum grade of C or NRSG 3334 with a minimum grade of C or NRSG 3334 with a minimum grade of C )

**Corequisite(s):** NRSG 3345

**NRSG 3345. Clinical for NRSG 3344. (1 Hour)**

Focuses on applying the theories, principles, and concepts studied in NRSG 3344 to provide nursing care to the childbearing individual and their families through experiential learning. Offers students an opportunity to engage directly with patients, collaborate with healthcare teams, and navigate complex clinical scenarios. This hands-on experience not only reinforces classroom learning but also focuses on compassion, communication, and professional identity.

**Corequisite(s):** NRSG 3344

**NRSG 3400. Nursing and the Promotion of Mental Health. (3 Hours)**

Focuses on psychiatric mental health nursing, offering students an opportunity to obtain the knowledge and skills to promote adaptive responses and achieve health goals in individuals, families, and groups experiencing mental health challenges. Explores key concepts in personality development, therapeutic communication, identifying differential diagnoses, and psychiatric nursing care, with an emphasis on clinical judgment. Integrates evidence-based practices, critical thinking, and comprehensive mental health assessments to support holistic, patient-centered care. Examines self-concept, role functioning, and interdependence within group and community contexts. Emphasizes interprofessional collaboration, diverse intervention strategies, and the evaluation of therapeutic outcomes within psychiatric care frameworks.

**Prerequisite(s):** ((NRSG 2220 with a minimum grade of C or NRSG 2220 with a minimum grade of C or NRSG 2220 with a minimum grade of C or NRSG 2222 with a minimum grade of C or NRSG 2222 with a minimum grade of C or NRSG 2222 with a minimum grade of C); (NRSG 2221 with a minimum grade of C or NRSG 2221 with a minimum grade of C or NRSG 2221 with a minimum grade of C)) or graduate program admission

**Corequisite(s):** NRSG 3401

**NRSG 3401. Clinical for NRSG 3400. (2 Hours)**

Focuses on applying the theories, principles, and concepts learned in NRSG 3400 to provide psychiatric mental health nursing care through experiential learning. Engages directly with patients, collaborates with healthcare teams, and navigates complex clinical scenarios. Reinforces classroom learning.

**Corequisite(s):** NRSG 3400

**NRSG 3420. Nursing Care of Adults 2. (4 Hours)**

Builds on the conceptual foundation established in NRSG 3320. Offers a comprehensive and systems-based model to support person and family centered care. Emphasizes complex decision making through collaborative practice and the use of evidence-based practices in high-acuity and critical care settings. Focuses on clinical judgment, integrating technology, and utilizing quality and safety principles. Offers students an opportunity to plan care for the acute client throughout the continuum of care as a means of holistic practice for the client with complex health problems.

**Prerequisite(s):** ((NRSG 3320 with a minimum grade of C or NRSG 3320 with a minimum grade of C or NRSG 3320 with a minimum grade of C); (NRSG 3321 with a minimum grade of C or NRSG 3321 with a minimum grade of C or NRSG 3321 with a minimum grade of C); (NRSG 3323 with a minimum grade of C or NRSG 3323 with a minimum grade of C or NRSG 3323 with a minimum grade of C or NRSG 3323 with a minimum grade of C or NRSG 3323 with a minimum grade of C); (NRSG 3324 with a minimum grade of C or NRSG 3324 with a minimum grade of C or NRSG 3324 with a minimum grade of C or NRSG 3324 with a minimum grade of C or NRSG 3324 with a minimum grade of C))

**Corequisite(s):** NRSG 3421

**NRSG 3421. Clinical for NRSG 3420. (2 Hours)**

Focuses on applying the theories, principles, and concepts covered in NRSG 3420 to provide nursing care to individuals and families with complex health issues through experiential learning. Engages directly with patients, collaborates with healthcare teams, and navigates complex clinical scenarios. Reinforces classroom learning.

**Corequisite(s):** NRSG 3420

**NRSG 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**NRSG 4502. Nursing Care of the Child. (4 Hours)**

Builds on developmental and family theory. Focuses on the principles of nursing care of children experiencing acute and/or complex, chronic health problems and their families. The complex health issues are analyzed within the context of the individual, family, and community. Offers students an opportunity to explore evidenced-based practices within the framework of the nursing process. The therapeutic role is addressed in partnership with the family and resources available within a collaborative and interdisciplinary environment.

**Prerequisite(s):** (NRSG 3420 (may be taken concurrently) with a minimum grade of C or NRSG 3420 (may be taken concurrently) with a minimum grade of C or NRSG 3420 (may be taken concurrently) with a minimum grade of C ); (NRSG 3421 (may be taken concurrently) with a minimum grade of C or NRSG 3421 (may be taken concurrently) with a minimum grade of C or NRSG 3421 (may be taken concurrently) with a minimum grade of C )

**Corequisite(s):** NRSG 4503

**NRSG 4503. Clinical for NRSG 4502. (2 Hours)**

Focuses on applying the theories, principles, and concepts learned in NRSG 4502 in providing nursing care for acutely and/or chronically ill children and their families in a pediatric clinical setting.

**Corequisite(s):** NRSG 4502

**NRSG 4504. Nursing Care of Children. (2 Hours)**

Focuses on the health promotion of children while building on developmental and family theory. Explores, through the nursing process, acute and complex chronic health conditions in the pediatric population utilizing evidence-based practices. Addresses the therapeutic role of the pediatric nurse in partnership with the family and resources available within a collaborative interprofessional environment, while considering the impact of social determinants of health on pediatric health outcomes.

**Prerequisite(s):** (NRSG 3320 with a minimum grade of C or NRSG 3320 with a minimum grade of C or NRSG 3320 with a minimum grade of C ); (NRSG 3333 with a minimum grade of C or NRSG 3333 with a minimum grade of C or NRSG 3333 with a minimum grade of C ); (NRSG 3334 with a minimum grade of C or NRSG 3334 with a minimum grade of C or NRSG 3334 with a minimum grade of C )

**Corequisite(s):** NRSG 4505

**NRSG 4505. Clinical for NRSG 4504. (1 Hour)**

Focuses on applying the theories, principles, and concepts studied in NRSG 4504 to provide nursing care of the child and family through experiential learning. Offers students an opportunity to engage directly with patients, collaborate with healthcare teams, and navigate complex clinical scenarios. Reinforces classroom learning.

**Prerequisite(s):** (NRSG 3320 with a minimum grade of C or NRSG 3320 with a minimum grade of C or NRSG 3320 with a minimum grade of C ); (NRSG 3333 with a minimum grade of C or NRSG 3333 with a minimum grade of C or NRSG 3333 with a minimum grade of C ); (NRSG 3334 with a minimum grade of C or NRSG 3334 with a minimum grade of C or NRSG 3334 with a minimum grade of C )

**Corequisite(s):** NRSG 4504

**NRSG 4604. Public Health Community Nursing. (3 Hours)**

Offers students an opportunity to learn the elements of population-focused practice through the application of the nursing process to the community as client. Focuses on health promotion and disease prevention strategies. Explores the role of the nurse in navigating ethical issues and health policy. Examines types of community-based strategies to serve diverse populations within urban, suburban, and rural communities. Focuses on the role of the nurse as a population-focused care provider, case manager, liaison between agencies, and nurse researcher.

**Prerequisite(s):** (NRSG 3344 with a minimum grade of C or NRSG 3344 with a minimum grade of C or NRSG 3344 with a minimum grade of C ); (NRSG 3345 with a minimum grade of C or NRSG 3345 with a minimum grade of C or NRSG 3345 with a minimum grade of C ); (NRSG 3400 with a minimum grade of C or NRSG 3400 with a minimum grade of C or NRSG 3400 with a minimum grade of C ); (NRSG 3401 with a minimum grade of C or NRSG 3401 with a minimum grade of C ); (NRSG 3420 with a minimum grade of C or NRSG 3420 with a minimum grade of C ); (NRSG 3421 with a minimum grade of C or NRSG 3421 with a minimum grade of C or NRSG 3421 with a minimum grade of C ); (NRSG 4504 with a minimum grade of C or NRSG 4504 with a minimum grade of C or NRSG 4504 with a minimum grade of C ); (NRSG 4505 with a minimum grade of C or NRSG 4505 with a minimum grade of C or NRSG 4505 with a minimum grade of C )

**Corequisite(s):** NRSG 4605

**Attribute(s):** NUpath Interpreting Culture

**NRSG 4605. Clinical for NRSG 4604. (2 Hours)**

Focuses on applying the theories, principles, and concepts covered in NRSG 4604 to provide population-focused nursing practice through experiential learning. Engages with populations. Reinforces classroom learning.

**Corequisite(s):** NRSG 4604

**Attribute(s):** NUpath Integration Experience

**NRSG 4610. Managing and Leading in Healthcare. (4 Hours)**

Examines effective management and leadership skills and introduces various theoretical frameworks that underpin leadership and management principles. Examines practical scenarios related to patient care management across different healthcare settings. Explores the roles of nurse managers and leaders, preparing students for nursing management practice in various healthcare contexts. Covers topics such as organizational structure, health policy, decision making, change management, communication skills, interprofessional collaboration, team building, ethical considerations, and interpersonal skills necessary for effective nursing leadership. Addresses organizational issues impacting clients, family, and staff outcomes.

**Prerequisite(s):** ((NRSG 3400 with a minimum grade of C or NRSG 3400 with a minimum grade of C or NRSG 3400 with a minimum grade of C );

(NRSG 3420 with a minimum grade of C or NRSG 3420 with a minimum grade of C or NRSG 3420 with a minimum grade of C ))

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**NRSG 4888. Care of the Perioperative Patient. (1 Hour)**

Introduces knowledge and skills needed to provide patient-centered care in preoperative, intraoperative, and postoperative settings. Emphasizes patient-centered assessment, preparation, and education, as well as maintaining a safe environment and assisting the surgical team during procedures. Reviews effective postsurgical care including monitoring for complications, managing pain, and promoting recovery. Offers students an opportunity to develop clinical judgment and understand the expertise necessary to support patients throughout the perioperative process to ensure positive outcomes.

**NRSG 4889. Transition into Nursing Practice. (3 Hours)**

Offers students an opportunity to integrate nursing knowledge, skills, and experiences with a focus on promoting diversity, equity, and inclusion in professional nursing practice. Emphasizes organizational leadership, quality improvement, and clinical judgment, with opportunities to apply these concepts in the care of selected populations. Examines critical professional domains and systems knowledge from previous clinical courses to ensure readiness for licensure and professional practice.

**Prerequisite(s):** (NRSG 3400 with a minimum grade of C or NRSG 3400 with a minimum grade of C or NRSG 3400 with a minimum grade of C ); (NRSG 3401 with a minimum grade of C or NRSG 3401 with a minimum grade of C or NRSG 3401 with a minimum grade of C ); (NRSG 3420 with a minimum grade of C or NRSG 3420 with a minimum grade of C or NRSG 3420 with a minimum grade of C ); (NRSG 3421 with a minimum grade of C or NRSG 3421 with a minimum grade of C or NRSG 3421 with a minimum grade of C ); (NRSG 3344 with a minimum grade of C or NRSG 3344 with a minimum grade of C or NRSG 3344 with a minimum grade of C ); (NRSG 3345 with a minimum grade of C or NRSG 3345 with a minimum grade of C or NRSG 3345 with a minimum grade of C ); (NRSG 4504 with a minimum grade of C or NRSG 4504 with a minimum grade of C or NRSG 4504 with a minimum grade of C ); (NRSG 4505 with a minimum grade of C or NRSG 4505 with a minimum grade of C or NRSG 4505 with a minimum grade of C )

**Corequisite(s):** NRSG 4996

**NRSG 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**NRSG 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** NRSG 4970 with a minimum grade of D-

**NRSG 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**NRSG 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**NRSG 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**NRSG 4995. Comprehensive Nursing Practicum. (2 Hours)**

Prepares students to synthesize nursing knowledge, skills, and experience and facilitate their transition to professional nursing practice and case management of clients with health problems. Assists students to demonstrate leadership and collaborative skills in working with other members of the health-care team through a weekly precepted relationship with a RN. Includes clinical learning experiences within hospital and community settings. Classwork includes a review of professional domains in all previous clinical courses in the nursing curriculum to prepare students for licensure.

**Prerequisite(s):** (NRSG 3420 with a minimum grade of C or NRSG 3420 with a minimum grade of C or NRSG 3420 with a minimum grade of C ); (NRSG 3421 with a minimum grade of C or NRSG 3421 with a minimum grade of C or NRSG 3421 with a minimum grade of C ); (NRSG 4502 with a minimum grade of C or NRSG 4502 with a minimum grade of C or NRSG 4502 with a minimum grade of C ); (NRSG 4503 with a minimum grade of C or NRSG 4503 with a minimum grade of C or NRSG 4503 with a minimum grade of C ); (NRSG 4604 (may be taken concurrently) with a minimum grade of C or NRSG 4604 (may be taken concurrently) with a minimum grade of C or NRSG 4604 (may be taken concurrently) with a minimum grade of C or NRSG 4604 (may be taken concurrently) with a minimum grade of C ); (NRSG 4605 (may be taken concurrently) with a minimum grade of C or NRSG 4605 (may be taken concurrently) with a minimum grade of C or NRSG 4605 (may be taken concurrently) with a minimum grade of C )

**Corequisite(s):** NRSG 4996

**NRSG 4996. Clinical for NRSG 4995 and NRSG 4889. (3 Hours)**

Offers students an opportunity to integrate nursing knowledge, skills, and experiences with a focus on promoting diversity, equity, and inclusion in professional nursing practice. Emphasizes organizational leadership, quality improvement, and clinical judgment, with opportunities to apply these concepts in the care of selected populations. Examines critical professional domains and systems knowledge from previous clinical courses to ensure readiness for licensure and professional practice.

**NRSG 4998. Nursing Skills Continuation. (0 Hours)**

Continues skills training requirements. May be repeated five times.

**NRSG 4999. Clinical Continuation. (0 Hours)**

Continues clinical requirements. May be repeated five times.

**NRSG 5000. Advanced Perspectives in Wellness. (4 Hours)**

Explores wellness through both theoretical and experiential pathways. Introduces theories and models of holism, wellness, stress, health promotion, health belief, and change as operational frameworks to reflect upon personal history, health and risk-taking behaviors, and lifestyle choices that influence health and well-being. Studies and relates the art and science of self-care to evidenced practices and the use of technology. Correlates wellness and one's ability to practice in healthcare. Reviews topics such as the self-care mindset and its application to minority populations.

**NRSG 5117. Advanced Pharmacology. (2 Hours)**

Focuses on principles of pharmacology and the major drug classifications in relation to the treatment of health problems across the life span. Examines the effects of selected medications on pathophysiology and psychopathology. Emphasizes dose response, side effects/drug interactions, route of administration, and place in clinical therapy.

**NRSG 5118. Healthcare System and Professional Role Development. (3 Hours)**

Examines the role of the advanced practice nurse within the context of today's healthcare system. Focuses discussion on dimensions of the advanced practice nursing role, including intra/interdisciplinary collaboration, consultation, leadership, diversity, and accountability for quality care. Examines the healthcare system with special focus on social, political, economic, ethical, regulatory, research, and legal trends. Students are expected to evaluate the interaction between healthcare system issues and advanced practice role dimensions.

**NRSG 5120. Statistics for Health Science. (3 Hours)**

Focuses on applying formal reasoning to understand the underlying principles of statistics; how to select and conduct statistical tests; and how to interpret and use the results of data analysis in relation to research questions and research hypotheses.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**NRSG 5121. Epidemiology and Population Health. (3 Hours)**

Examines the theoretical basis for identification and analysis of the distribution and determinants of health problems at community, national, and international population levels. Considers health disparities that exist among specific populations and the role of government in setting policies for health promotion and disease prevention. Covers three topical areas: basic principles and population measures of epidemiology; epidemiologic study methods; and application of epidemiologic tools in interdisciplinary settings. Complements planned topics with current examples of population health issues. The goal is to understand the principles and practice of monitoring population health. Skills acquired assist advanced practice nurses, other clinicians, or administrators in critically evaluating new epidemiologic literature and in using the basic tools of epidemiology to assess population health and develop strategies for monitoring health improvement.

**NRSG 5126. Pathophysiology for Advanced Practice. (3 Hours)**

Covers content that provides current understanding of major disease processes across the life span. Builds on the knowledge of anatomy, physiology, biochemistry, microbiology, and immunology. Focuses on physiologic dysfunction; physiologic adaptation in maintaining the internal environment; and feedback mechanisms at the cellular, organ, and systems level. Seeks to provide students with a way of thinking about disease for each body system. Provides a comprehensive study of underlying concepts common to major pathophysiologic processes of the body, including specific diseases affecting the cardiovascular, endocrine, gastrointestinal, hematological, immunological, nervous, pulmonary, and renal systems.

**NRSG 5220. Introduction to Research Methods and Application for Healthcare. (4 Hours)**

Presents evidence-based practice and research methodologies to design and implement a high-quality collaborative research project. Critically appraises published research. Studies how to translate research findings into clinical practice, survey techniques, sampling strategies, ethical considerations in the protection of research participants, and the dissemination of research findings. Reviews how health innovations serve as a foundation for scientific inquiry to address client and community-focused issues that require solutions through the development of nursing knowledge and practice.

**Attribute(s):** NUpath Natural/Designed World, NUpath Writing Intensive

**NRSG 5976. Directed Study. (1-4 Hours)**

Allows student to develop an individualized plan to attain specific knowledge and skills related to professional goals. May consist of library study and reading, individual instruction, research, practicum, or other appropriate activity as approved by instructor and academic adviser. May be repeated without limit.

**NRSG 6115. Health Assessment. (3 Hours)**

Focuses on human physiology and the development of advanced health assessment knowledge and skills related to performing regional and comprehensive examinations of the client across the life span. Includes variables among cultural groups. Students synthesize knowledge from nursing, physical, social, and health sciences as they analyze data collected in the assessment process. Focuses on interviewing skills and systematic performance, analysis and documentation of health assessment process. Differentiation of normal and abnormal findings is emphasized utilizing critical thinking. Introduces the student to diagnostic reasoning within the scope of practice of the nurse in the advanced practice role. *Nursing degree students only.*

**NRSG 6116. Advanced Health Assessment of the Neonate and Infant. (3 Hours)**

Focuses on human physiology and the development of advanced health assessment skills to build a knowledge base with which to perform a thorough assessment and examination of the neonate and infant. Offers students an opportunity to learn to evaluate family history through chart review and direct interviewing to gain knowledge of the neonate and to anticipate certain findings based on information gained through a thorough assessment and physical examination. Emphasizes identifying normal from abnormal findings through critical thinking, introducing the student to diagnostic reasoning, which is the basis of the advance practice nurse role.

**NRSG 6220. Nursing Management: Acute Episodic Illness. (3 Hours)**

Addresses the assessment, preventive, and health maintenance theories of healthcare utilized by the acute-care advanced practice nurse. Includes common problems causing episodic and acute illnesses and the advanced nursing management skills needed to address them and implement initial management skills. Uses current theories and research from nursing and the physical and behavioral sciences as a basis for clinical decision making, with an emphasis on critical thinking and diagnostic reasoning. The nursing process and life cycle are integral frameworks used to structure the delivery of course content. Restricted to students in selected nursing programs or with permission of instructor.

**Prerequisite(s):** NRSG 6115 with a minimum grade of B ; (NRSG 5126 with a minimum grade of B or NRSG 5126 with a minimum grade of B ); (NRSG 6222 with a minimum grade of B or NRSG 6325 with a minimum grade of B )

**Corequisite(s):** NRSG 6420

**NRSG 6221. Nursing Management: Critical and Chronic Illness. (3 Hours)**

Emphasizes the acquisition of theoretical knowledge essential to understanding the common life-threatening and chronic, long-term pathophysiological problems, differential diagnosis, and related advanced nursing care of critically and chronically ill individuals and families. Addresses common problems causing critical, life-threatening illnesses, the chronic sequelae from these problems, and the advanced nursing management skills needed to address them. Uses current theories and research from nursing and the physical and behavioral sciences as a basis for clinical decision making, with an emphasis on critical thinking and diagnostic reasoning. The nursing process and life cycle are integral frameworks used to structure the delivery of course content. Restricted to students in selected nursing programs or with permission of instructor.

**Prerequisite(s):** NRSG 6220 with a minimum grade of B ; (NRSG 6222 with a minimum grade of B or NRSG 6325 with a minimum grade of B )

**Corequisite(s):** NRSG 6421

**NRSG 6222. Pharmacology of Adults and Older Adults. (2 Hours)**

Covers age-related changes in pharmacokinetics and pharmacodynamics and the prescription, administration, and monitoring of medications for older adults. Includes a detailed discussion of the most common drugs and classes of drugs prescribed for the elderly, as well as the signs and symptoms of drug toxicity particular to older adults. Investigates the impact of race/ethnicity on prescribing practices. Also discusses medication history guidelines for older adults, age-related considerations in prescribing for the elderly, and methods to support drug compliance and prevent inappropriate drug use and adverse drug reactions. Examines over-the-counter drug use among older adults. Emphasis is on the problem of polypharmacy for the older adult and the prevention, recognition, and treatment of drug interactions among older adults.

**Prerequisite(s):** NRSG 5117 with a minimum grade of B or NRSG 5117 with a minimum grade of B

**NRSG 6230. Nursing Management: Critically Ill Neonatal 1. (3 Hours)**

Focuses on the acquisition of knowledge about complex physiological concepts essential to the care of the critically ill neonate. Begins with the actual and potential alterations in fetal/neonatal well-being, adaptation to extrauterine life, and factors that interfere with adaptation to extrauterine life. Also emphasizes the acquisition of theoretical knowledge essential to understanding the neonate's response to life-threatening problems. Discusses neonatal pathophysiologic disorders in terms of the nursing process and management of the neonate and their families. Uses current theories and research from nursing, biomedical, physical, and behavioral sciences as a basis for clinical decision making. The nursing process and developmental theory are frameworks utilized to structure the delivery of course content.

**NRSG 6231. Nursing Management: Critically Ill Neonatal 2. (3 Hours)**

Continues NRSG 6230. Covers the acquisition of theoretical knowledge essential to understanding the neonate's response to life-threatening problems. Discusses neonatal pathophysiologic disorders in terms of the nursing process and management of the neonate and their families. Uses current theories and research from nursing, biomedical, physical, and behavioral sciences as a basis for clinical decision making. The nursing process and developmental theory are frameworks utilized to structure the delivery of course content.

**Prerequisite(s):** NRSG 6230 with a minimum grade of B

**NRSG 6232. Neonatal Pharmacology. (2 Hours)**

Focuses on building upon basic knowledge in pharmacology and providing content essential for nurses in the expanded role. Examines the principles of pharmacology and major drug classifications as they relate to the causes and treatment of health and illness problems affecting critically ill neonates.

**Prerequisite(s):** NRSG 5117 with a minimum grade of B or NRSG 5117 with a minimum grade of B

**NRSG 6241. Acute-Care Concepts in Nursing Practice. (3 Hours)**

Focuses on the analysis and application of core physiological, behavioral, environmental, and psychosocial concepts essential for advanced nursing care of acute and critically ill individuals. Topics include the utility and clinical implications of monitoring technology available in the acute-care setting, the acute-care environment and its impact on patient and family systems, and the concepts of stress, grief, and coping. Also addresses the advanced nursing management of the multiple trauma patient and the related physiologic and clinical concepts. Opportunity is provided for exploration and development of concepts unique to each student's area of concentration within the acute-care specialization. Restricted to students in selected nursing programs or with permission of instructor.

**Prerequisite(s):** NRSG 6221 with a minimum grade of B ; (NRSG 6222 with a minimum grade of B or NRSG 6325 with a minimum grade of B )

**Corequisite(s):** NRSG 6422

**NRSG 6243. Diagnostic Reasoning and Clinical Decision Making in Acute Care. (2 Hours)**

Explores the ideas and concepts of diagnostic reasoning and clinical decision making. Examines decision making theory, cognitive bias, and resource management to scaffold the learning. Analyzes diagnosis through tests using current evidence. Reviews radiologic studies including x-rays, ultrasound and Computed Tomography (CT) imaging, as well as metabolic panels and microbiologic data that impact the patient management of patients in the acute care setting.

**Prerequisite(s):** NRSG 5117 with a minimum grade of B or NRSG 5117 with a minimum grade of B

**NRSG 6245. Advanced Practice Colloquium in Acute Care. (2 Hours)**

Explores current evidence-based practices, new advances, and ongoing research on topics in the field of advanced practice nursing across specialties. Includes ethical principles; licensure and practice issues; cancer; and respiratory, cardiovascular, and endocrine disorders. Discusses social justice issues involved in the management of the acute care patient, navigating disparities in healthcare, as well as culturally competent care and considerations that impact the care and management of patients in the acute care setting.

**NRSG 6246. Acute Care Pharmacology. (2 Hours)**

Explores the pharmacological agents used in the management of critical illness. Reviews pharmacokinetic and pharmacodynamic principles, as well as mechanism of action and elimination, that serve as the foundation for several classes of critical care pharmacologic agents.

**Prerequisite(s):** NRSG 5117 with a minimum grade of B or NRSG 5117 with a minimum grade of B

**NRSG 6249. Health Promotion of Adult/Older Adult. (3 Hours)**

Focuses on the assessment, preventative, and health maintenance and promotion theories utilized by advanced practice nurses. Includes the impact of political, psychological, sociological, and physiological factors on the healthcare continua of the adolescent/adult/older adult. Explores self-modeling of health behaviors and institution of primary and secondary preventative strategies in the home, community, workplace, and primary care facility. Discusses and utilizes theoretical and strategic approaches to behavior change necessary for health promotion.

**Prerequisite(s):** NRSG 6115 with a minimum grade of B or NRSG 6115 with a minimum grade of B

**Corequisite(s):** NRSG 6449

**NRSG 6253. Primary Care of Adult/Older Adult Health Problems. (3 Hours)**

Building upon NRSG 6252, seeks to further develop the intellectual and attitudinal competencies necessary for successful performance as a primary healthcare provider. Focuses on assessment, diagnosis, and management of adolescents/adults/older adults with minor acute and stabilized chronic illness in the community and long-term care facility. Emphasizes the nurse practitioner role functions of collaborative interdisciplinary management, consultation, and referral skills.

**Prerequisite(s):** NRSG 6249 with a minimum grade of B

**NRSG 6254. Primary Care of Adult/Older Adult Complex Patients. (3 Hours)**

Focuses on the assessment and intervention of adults/older adults with complex multisystem health problems/diseases in primary care and long-term care settings. Utilizes knowledge from pathophysiology, pharmacology, and psychosocial sciences to increase knowledge and skill of the advanced practice nurse in the care of adults/older adults with complex problems. Teaches students about the role and expertise of advanced practice nurses and other professionals in diverse settings.

**Prerequisite(s):** NRSG 6253 with a minimum grade of C-

**NRSG 6262. Pediatric Pharmacology. (2 Hours)**

Focuses on the principles of pharmacology and the major drug classifications in relation to the treatment of health problems during childhood and adolescence. Examines the effects of selected medications on pathophysiology and psychopathology. Discusses the implication of practice.

**Prerequisite(s):** NRSG 5117 with a minimum grade of B or NRSG 5117 with a minimum grade of B

**NRSG 6264. Care of Well Child/Adolescent Health Promotion. (3 Hours)**

Focuses on the health assessment of newborns, children, adolescents, and their families within a community. Discusses issues most pertinent to the various ages of the well child within a culturally-competent primary care framework of anticipatory guidance and health promotion. Emphasizes the utilization of a comprehensive approach to preventative healthcare by examining the impact of psychological, sociological, developmental, behavioral, cultural, and physiological factors on the child's health status within the family and community. Includes routine healthcare maintenance, screening, developmental issues, genetic implications, family dynamics, confidentiality, adoption, global health, self-care, and common health concerns encountered in pediatric primary care settings.

**Prerequisite(s):** NRSG 6115 with a minimum grade of B

**Corequisite(s):** NRSG 6460

**NRSG 6265. Care of Child/Adolescent Health Problems. (3 Hours)**

Further develops the intellectual and attitudinal competencies necessary for the student to successfully perform as a pediatric nurse practitioner across a variety of settings and continuum of care. Focuses on evidence-based care of acute and chronic health problems seen in infants through young adults in primary and urgent care. Encompasses assessment, diagnosis, and management of children with acute and chronic health problems. Considers family, cultural, and community context. Emphasizes the nurse practitioner role, including the development of consultation and referral skills.

**Prerequisite(s):** NRSG 6264 with a minimum grade of B

**Corequisite(s):** NRSG 6461

**NRSG 6267. Care of the Critically Ill Child. (3 Hours)**

Builds on foundational principles of the primary, acute, and chronic care and explores the scope of practice of PNPs in meeting the specialized needs of children with complex acute, complex chronic, and critical conditions including life-threatening illnesses, trauma, and organ failure. Emphasizes monitoring and ongoing management of intensive therapies in various settings in a collaborative model. Focuses on how acute and critical health needs influence decision-making, treatment, follow-up, and transition of care. Offers of the opportunity to obtain the knowledge and skills necessary to meet the unique needs of fragile children, including urban children who are at risk for poor health outcomes. Offers a unique experience that allows exploration of emerging trends and patterns of healthcare practices across the continuum of care.

**Prerequisite(s):** NRSG 6265 with a minimum grade of B

**Corequisite(s):** NRSG 6463

**NRSG 6275. Health Promotion and Preventative Care in Pediatrics in the Context of Community Health. (4 Hours)**

Examines issues in caring for pediatric patients and their families at risk for poor health outcomes utilizing the framework of the Healthy People Indicators. Explores emerging trends of healthcare practices in high-risk settings across the continuum of care and within its social and environmental context by integrating this unique, collaborative experience. Offers mentoring to consider current issues inherent in caring for underserved populations through the utilization of innovative strategies. Focuses on delivery of care to families and children in the community, which could pose challenges to nurse practitioners, including the need to gain new knowledge, develop nonbiased attitudes, and master skills and competencies to address health promotion and prevention needs.

**Prerequisite(s):** NRSG 6115 with a minimum grade of B

**NRSG 6276. Diagnostic Reasoning and Clinical Decision Making in PNP Practice. (2 Hours)**

Builds on a foundation of comprehensive health assessment of the child and family and associated pediatric nurse practitioner competencies to synthesize patient health information through advanced diagnostic reasoning and clinical decision-making to deliver a sound plan of care for pediatric patients with acute and chronic health problems. Focuses on expanding differential diagnosis skills, diagnostic test result interpretation, and embracing more autonomous pediatric nurse practitioner role for transition into practice. Considers ethical, cultural, and community context and wellness principles.

**NRSG 6281. Dimensions of Clinical Psychiatric Practice. (3 Hours)**

Focuses on psychodiagnostic history taking, mental status evaluation, case formulations, and designs of psychiatric treatment contracts for clients. Studies the major forms of psychopathology, clinical theory, and the use of diagnostic treatment criteria to aid clinical decisions with clients across the life span. Addresses prevention and treatment approaches for populations at risk. Identifies outcome indicators and goal-setting strategies.

**NRSG 6282. Clinical Psychopharmacology. (3 Hours)**

Presents a comprehensive overview of major classes of psychotropic medications and the related psychiatric disorders associated with medication prescriptions for diverse clients across the life span. Emphasizes advanced practice clinical nursing decision making related to the choice of medication, differential diagnosis, drug interactions, and safe monitoring. Covers side effects and integration of medication management into a holistic comprehensive psychiatric treatment plan.

**Prerequisite(s):** NRSG 5117 with a minimum grade of B or NRSG 5117 with a minimum grade of B

**NRSG 6283. Psychobiological Bases of Mental Health. (3 Hours)**

Focuses on biological and psychological correlates of major psychiatric disorders. Studies anatomical and functional aspects of the brain and central and autonomic nervous systems. Considers cellular, genetic, neurotransmitter, circuitry, neurochemical, and neuroendocrine dimensions of emotions, behaviors, and psychiatric symptoms. Reviews the psychiatric accompaniments of physical illness and the need to differentiate medical and psychiatric conditions. Emphasizes the integration of biological with psychosocial approaches across the life span.

**NRSG 6286. Contemporary Psychotherapies—Theory and Practice. (3 Hours)**

Introduces the theory and practice of various forms of psychotherapy. Discusses theory and techniques associated with each therapy with regard to theoretical underpinnings, therapeutic action, techniques, and relationship between the advanced practice nurse therapist and client. Explores therapy application of individual, family, and group theories to different diagnostic populations across the life span. Compares and contrasts different psychotherapeutic perspectives on case formulation.

**Prerequisite(s):** NRSG 6281 with a minimum grade of B

**NRSG 6287. Child and Adolescent Psychopharmacology. (2 Hours)**

Focuses on prescribing psychotropic medications for pediatric populations. Applies principles for delivery of psychiatric care for children and adolescents with acute and chronic psychiatric mental health diagnoses by demonstrating assessment, diagnostic reasoning and clinical decision-making with clinical cases. Emphasizes complex issues related to psychiatric medications for children, considering ethical, cultural, family and school contexts.

**Prerequisite(s):** NRSG 6282 with a minimum grade of B

**NRSG 6288. Geriatric and Aging Adult Psychopharmacology. (2 Hours)**

Offers a comprehensive overview of psychiatric disorders and the biopsychosocial issues associated with medication prescription, differential diagnosis, drug interactions, and safe monitoring with attention to side effects for geriatric and aging adult populations. Also offers a comprehensive overview of major classes of psychotropic medications and integration of medication management into a treatment regimen for geriatric and aging adult clients. Uses clinical cases to illustrate complex issues related to prescribing psychiatric medications for the geriatric population.

**NRSG 6300. Healthcare Finance and Marketing. (3 Hours)**

Covers healthcare economics and the financial and marketing functions and responsibilities of healthcare leaders. Emphasizes the decision-making process involved in assuring financial management and management of the exchange process between an organization and its "publics" by which both parties satisfy their needs and wants (marketing). Focuses on the integration of clinical and business aspects of healthcare into decision making for the advanced practice nurse leader.

**NRSG 6302. Health Policy and Law. (3 Hours)**

Examines health policy and health laws by advanced practice nurses from the perspective of issues pertinent to public health, populations, communities, their healthcare, and its coordination. Reviews and criticizes court decisions, legislation, federal, and state regulatory activities relevant to healthcare and health policy initiatives. Discusses the concept of continuous quality improvement through the development of standards of care and evaluation outcomes. Explores healthcare as a vital part of a national care agenda. Concepts are presented for application through the manager-as-developer model, which includes influence, vision, two-way communication, autonomy, team building, and development.

**NRSG 6306. Health Informatics. (3 Hours)**

Seeks to prepare students to use information systems and technology to support and improve patient care and healthcare systems. Examines the meta-structures (data, information, knowledge, and wisdom), concepts and tools of nursing, and healthcare informatics. Focuses on information literacy, including a critical examination of both electronic patient health information and provider decision support resources. Covers ethical and legal issues, including privacy and security, related to electronic systems. Database concepts, including data mining, warehousing, electronic data collection, and aggregation for research and patient care, are important components of this course. Examines the role of the nurse as a change agent during health information technology implementation. Students who do not meet course prerequisites may seek permission of instructor.

**NRSG 6341. Teaching Nursing: The Art and Science. (3 Hours)**

Explores various learning theories and their application to practice disciplines. Emphasizes efforts to enhance critical thinking and problem solving, with assessment of technological aids for learning. Examines teaching modalities as they relate to increasing levels of complexity of information. Introduces the assessment of teaching effectiveness.

**NRSG 6390. Family Care of the Adult/Older Adult Patient. (4 Hours)**

Focuses on the assessment, diagnosis, and management of minor acute and stabilized chronic conditions in the adult and older adult populations in the community and long-term-care facilities. Explores theories of health promotion and health maintenance. Discusses the impact of political, psychological, sociological, and physiological factors as they impact the care of the adult and older adult. Emphasizes the role of the advanced-practice nurse practitioner as a member of collaborative teams, consultant, and model of health behaviors.

**Prerequisite(s):** NRSG 6115 with a minimum grade of B

**NRSG 6391. Practicum for NRSG 6390. (4 Hours)**

Offers a clinical practicum focusing on the adult and older adult with risk for premature morbidity and mortality and family centered health promotion. Emphasizes the care of the adult with complex multisystem health problems and conditions. Explores care of individuals in acute- and long-term-care settings.

**Prerequisite(s):** NRSG 6390 (may be taken concurrently) with a minimum grade of B

**NRSG 6392. Family Theory. (2 Hours)**

Focuses on the assessment and management of the changing family structure across the life span of the family. Emphasizes the identification of families at risk for premature morbidity and mortality. Presents guiding principles and strategies for assessing the family, various theories of family structure and process, and techniques for engaging and connecting with families. Explores the family as an emotional unit, the individual patient as a member in his or her family of origin, and strategies for applying this knowledge in a clinical setting.

**NRSG 6393. Family Care of the Pediatric and Adolescent Patient. (4 Hours)**

Focuses on the health assessment of individuals from the newborn stage into young adulthood. Emphasizes the utilization of an evidence-based approach to acute and chronic health conditions. Considers family, cultural, and urban community context and anticipatory guidance and health promotion within a culturally competent framework.

**Prerequisite(s):** NRSG 6392 with a minimum grade of B

**Corequisite(s):** NRSG 6394

**NRSG 6394. Practicum for NRSG 6393. (4 Hours)**

Offers a clinical practicum focusing on providing students with clinical learning experiences in the performance of comprehensive health assessments of children and families within the urban community. Using an evidence-based and culturally competent approach, emphasizes health promotion, health maintenance, and protection, as well as identification of children and families at risk. Offers students an opportunity to learn to assess, diagnose, and manage chronic conditions and acute illnesses commonly encountered in childhood, adolescence, and young adulthood. Builds on a foundation of practice behaviors in health assessment, health promotion, and disease prevention with a particular focus on urban health.

**Corequisite(s):** NRSG 6393

**NRSG 6395. Healthcare of Women in Family Practice. (2 Hours)**

Discusses health assessment, promotion, and care of women through the life span. Emphasizes the perinatal time period.

**Prerequisite(s):** NRSG 6393 with a minimum grade of B

**Corequisite(s):** NRSG 6396

**NRSG 6396. Practicum for NRSG 6395. (4 Hours)**

Focuses on the assessment, diagnosis, and management of acute and chronic health conditions of women and families. Emphasizes the care of women during the perinatal and postpartum periods. Explores family health as the family structure changes across its life span. Emphasizes the role of the advanced-practice nurse practitioner as a member of collaborative teams, as a consultant, and as a model of health behaviors.

**Corequisite(s):** NRSG 6395

**NRSG 6397. Healthcare of Women and the Pregnant Individual in Family Practice. (3 Hours)**

Focuses on the care of adolescent, adult, and elderly female-bodied individuals, and those identifying as female, in various healthcare settings. Presents a general review of health assessment and health promotion for these populations. Includes the diagnosis, monitoring, and treatment of commonly occurring conditions encountered by female-bodied individuals and those identifying as female. Emphasizes care throughout the perinatal period.

**NRSG 6398. Prescribing Considerations in the Pediatric and Adolescent Populations. (2 Hours)**

Focuses on prescribing considerations in the pediatric and adolescent populations, including prescribing for the pregnant and lactating individual and across the life span of the child from birth to adolescence. Discusses prescription of over-the-counter medications and common herbal supplements. Presents factors influencing prescriptive habits such as adolescent agency, implicit bias, and family dynamics.

**Prerequisite(s):** (NRSG 5117 with a minimum grade of B or NRSG 5117 with a minimum grade of B ); NRSG 6222 with a minimum grade of B

**NRSG 6420. Adult-Gerontology Acute-Care Nursing Practicum 1. (2 Hours)**

Focuses on the assessment, preventative, and health-maintenance aspects of acute and episodic healthcare to adults (including older adults). The clinical practice emphasizes the multiple factors affecting the adult patient across the life span. The application of theory to the care of these patients through participation, observation, and research is facilitated by assignment to a clinical preceptor. Weekly seminars focus on an array of issues surrounding the role of the advanced practice nurse. Requires students to practice in the clinical setting a minimum of eight hours per week.

**Corequisite(s):** NRSG 6220

**NRSG 6421. Adult-Gerontology Acute-Care Nursing Practicum 2. (4 Hours)**

Continues NRSG 6420. Offers students individualized experiences in the role of practitioner, educator, and manager. Facilitated by assignment to a clinical preceptor, students focus on the provision of care to adults (including older adults) experiencing complex, critical, and chronic health problems. Demonstrates how to assess, diagnose, and manage illnesses in the acute-care, chronic, or rehabilitation setting. Uses concurrent weekly seminars to focus on the roles of the advanced practice nurse. Requires students to practice in the clinical setting a minimum of twenty hours per week.

**Prerequisite(s):** NRSG 6420 with a minimum grade of B

**Corequisite(s):** NRSG 6221

**NRSG 6422. Adult-Gerontology Acute-Care Nursing Practicum 3. (4 Hours)**

Continues NRSG 6421. Offers students an opportunity to synthesize their previous learning experiences; to plan, deliver, and evaluate advanced nursing care to patients with complex healthcare problems; and to acquire the skills necessary to manage clients in an acute-care setting. Uses concurrent weekly seminars to analyze the impact of the advanced practice role on long-term patient care, interdisciplinary relationships, and healthcare policy. Requires students to practice in the clinical setting a minimum of twenty hours per week.

**Prerequisite(s):** NRSG 6421 with a minimum grade of B

**Corequisite(s):** NRSG 6241

**NRSG 6430. Neonatal Clinical Practicum 1. (4 Hours)**

Focuses on the skills necessary for management of the high-risk neonate and family. Students have the opportunity to provide direct care under the supervision of NNP preceptors in the hospital neonatal intensive care unit (NICU), responsible for daily management of a specified caseload of neonates and their families, including therapeutic and diagnostic procedures. Supervised delivery room management of the high-risk neonate is expected, where available. Seeks to familiarize the student with respiratory distress syndrome, transient tachypnea, pneumonia, pulmonary hypertension, congenital heart disease, and patent ductus arteriosus, with appropriate management strategies. Requires students to practice in the clinical setting a minimum of twenty hours per week.

**NRSG 6431. Neonatal Clinical Practicum 2. (4 Hours)**

Continues NRSG 6430. Offers the second in a series of three courses focusing on the acquisition of clinical skills necessary for patient management of the high-risk neonate and family. Students have the opportunity to provide direct care under the supervision of NNP or neonatologist preceptors in the hospital neonatal intensive care unit (NICU), responsible for daily management of a specified caseload of neonates and their families, including therapeutic and diagnostic procedures. Supervised delivery room management of the high-risk neonate is expected, where available. Seeks to familiarize the student with disease processes commonly encountered in the term and preterm infant populations and appropriate management strategies. Requires students to practice in the clinical setting a minimum of twenty hours per week.

**Prerequisite(s):** NRSG 6430 with a minimum grade of B

**NRSG 6432. Neonatal Clinical Practicum 3. (2 Hours)**

Continues NRSG 6431. Offers the final course in the series focusing on the acquisition of clinical skills and expertise necessary for patient management of the high-risk neonate and family. Provides the student with intensified experience in the hospital neonatal intensive care unit (NICU) providing direct care under the supervision of NNP or neonatologist preceptors. The student is responsible for daily management of a specified caseload of neonates and their families. Proficient delivery room management of the high-risk neonate is an expectation. The student should exhibit the ability to function as an independent novice practitioner with preceptor support.

**Prerequisite(s):** NRSG 6431 with a minimum grade of C-

**NRSG 6449. Health Promotion of Adult/Older Adult Practicum. (1 Hour)**

Applies knowledge acquired in NRSG 6249. Focuses on the assessment and health promotion of adults/older adults in the primary care settings. Utilizes selected clinical experiences to increase and apply health and risk-assessment skills with adult populations in the community. Also offers students an opportunity to acquire a beginning knowledge of the role of the adult/older adult nurse practitioner in primary care settings.

**Prerequisite(s):** NRSG 6115 with a minimum grade of B or NRSG 6115 with a minimum grade of B

**Corequisite(s):** NRSG 6249

**NRSG 6450. Adult/Older Adult Practicum 1. (5 Hours)**

Provides a clinical learning experience that correlates with the content presented in NRSG 6250. Focuses on assessment of the adult life span within a holistic framework. Emphasizes identification of individuals at risk for premature morbidity and mortality, as well as focusing on advanced health assessment techniques and interpretation of abnormal findings on physical examination and developing a client/family health-promoting plan of care within the advanced practice role of the nurse practitioner. Requires students to practice in the clinical setting a minimum of sixteen hours per week.

**Prerequisite(s):** NRSG 6249 with a minimum grade of B ; NRSG 6449 with a minimum grade of B

**NRSG 6451. Adult/Older Adult Practicum 2. (5 Hours)**

Continues NRSG 6450. Focuses on providing the student with clinical learning experiences in the coordination and delivery of primary healthcare nursing services to adults and their families, with emphasis on underserved populations. Studies how to assess, diagnose, and manage acute and chronic conditions and illnesses commonly encountered in adult populations. Students build on a foundation of practice behaviors in health assessment, health promotion, and disease prevention. Requires students to practice in the clinical setting a minimum of sixteen hours per week.

**Prerequisite(s):** NRSG 6450 (may be taken concurrently) with a minimum grade of C-

**NRSG 6459. Pediatric NP Practicum 1. (2 Hours)**

Provides clinical learning experiences in the delivery and coordination of primary-care services to well infants, children, adolescents, and young adults and their families. Focuses on performing a comprehensive health assessment of the child and family utilizing a holistic approach while considering social determinants of health and caring for underserved populations. Emphasizes child development, health promotion, health maintenance, and identification of individuals, families, and communities at risk.

**NRSG 6460. Pediatric NP Practicum 2. (5 Hours)**

Provides clinical learning experiences in the delivery and coordination of primary care services to well infants, children, adolescents, and young adults and their families. Focuses on performing a comprehensive health assessment of the child and family utilizing a holistic approach. Emphasizes health promotion, health maintenance, and identification of individuals or families at risk.

**Corequisite(s):** NRSG 6264

**NRSG 6461. Pediatric NP Practicum 3. (5 Hours)**

Builds on a foundation of practice behaviors in health assessment, health promotion, and disease prevention. Enhances prior knowledge, and attitudinal competencies and skills in the assessment, diagnosis, and management of children with acute and chronic health issues across a variety of settings and continuum of care. Focuses on providing clinical learning experiences in the coordination and delivery of care to infants, children, adolescents, and young adults and their families within the context of their culture and community.

**Corequisite(s):** NRSG 6265

**NRSG 6463. Care of the Critically Ill Child Practicum. (5 Hours)**

Focuses on providing clinical learning experiences in the coordination and delivery of complex acute, complex chronic, and critical care to infants, children, adolescents, and young adults and their families. Offers clinical practice experiences across settings and continuum of care acuity and complexity. Facilitates knowledge, and attitudinal competencies and skills in the delivery of care to children with a focus on complex acute and critical health issues. Emphasizes assessment, diagnosis, and management of complex acute, complex chronic, and critical conditions and illnesses encountered in infancy, childhood, adolescence, and young adulthood. Builds on a foundation of practice behaviors in health assessment, health promotion, and disease prevention.

**Prerequisite(s):** NRSG 6461 with a minimum grade of B

**Corequisite(s):** NRSG 6267

**NRSG 6480. Psychiatric Practicum across the Life Span 1. (5 Hours)**

Provides clinical experience with individuals and families throughout the life span in a psychiatric mental health setting in the advanced practice nursing role. Includes a didactic seminar that focuses on assessment of psychopathology and mental health, psychodiagnostic history taking, mental status evaluation, differential diagnosis, and treatment for various aged diverse clients. Direct care hours are completed toward certification eligibility. Offers an opportunity to demonstrate achievement of entry-level advanced practice skills.

**Prerequisite(s):** NRSG 6281 (may be taken concurrently) with a minimum grade of B ; NRSG 6282 (may be taken concurrently) with a minimum grade of B ; NRSG 6283 (may be taken concurrently) with a minimum grade of B ; NRSG 6286 (may be taken concurrently) with a minimum grade of B

**NRSG 6481. Psychiatric Practicum across the Life Span 2. (5 Hours)**

Provides clinical experiences with individuals and families throughout the life span in a mental health setting. The focus is on planning and providing care, utilizing various treatment modalities, applying theoretical frameworks, prevention of psychiatric problems and promotion of mental health, group process, termination issues, and evaluation of clients' progress. Direct care hours are completed toward certification eligibility. Offers an opportunity to enhance advanced practice skills through increased clinical experiences.

**Prerequisite(s):** NRSG 6480 with a minimum grade of B

**NRSG 6560. Nurse Practitioner Clinical Intensive. (1 Hour)**

Offers the graduate nurse practitioner student learning activities to demonstrate clinical competency when obtaining a health history and performing a comprehensive physical examination on an adult. Emphasizes clinical critical thinking and decision making in a simulation learning environment in preparation for Advanced Practice Registered Nurse (APRN) patient management. Offers students an opportunity to perform in-person patient assessments to incorporate concepts of advanced pathophysiology and pharmacology into clinical decision making and care planning via case review.

**Prerequisite(s):** NRSG 6115 (may be taken concurrently) with a minimum grade of B

**NRSG 6561. Advanced Nurse Practitioner Clinical Intensive. (1 Hour)**

Offers the graduate nurse practitioner student an opportunity to prepare for national certification. Focuses on refinement of clinical skills. Includes in-person patient assessments to determine therapeutic interventions, review diagnostic reasoning, and incorporate prescriptive authority via case presentations. Emphasizes clinical critical thinking and decision making in a simulation learning environment in preparation for role transition to Advanced Practice Registered Nurse (APRN).

**NRSG 6864. Professional Preparation Seminar. (0 Hours)**

Seeks to prepare the newly graduated BSN student to take necessary steps for entry into the professional nursing role and workforce prior to beginning master's specialization. Focuses on strategies for the transition from student nurse to professional nurse.

**NRSG 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**NRSG 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**NRSG 7100. Leadership in Advanced Practice Nursing. (3 Hours)**

Seeks to provide a solid foundation for providing leadership. Analyzes the principles of transformational leadership and organizational behavior pertinent to healthcare systems. Seeks to prepare nursing leaders at the practice doctorate level to use critical thinking skills and evidence-based decision making to effect systems and organizational change. Discusses leadership skills and characteristics of leadership styles within the broader framework of interprofessional collaboration and innovations in healthcare delivery. Presents information from a variety of disciplines and perspectives (legal, fiscal, ethical, cultural, and political) for purposes of improving quality of care for patients, populations, and communities in healthcare settings across the continuum of care.

**NRSG 7104. Foundations in Nursing Research. (3 Hours)**

Addresses the development of nursing science with specific emphasis on the importance of developing theory-based research. Includes a broad review of the various types of research studies (e.g., descriptive, causal, and relational); the steps of the research process; and the related analytic strategies and/or issues associated with each type of research study. Also reviews the guidelines for conducting critical literature reviews (i.e., systematic or meta-analyses) and how the results are used to determine the type of research study to employ. Discusses the scientific principles and integrity related to the conduct of responsible research and the means for assuring ethical integrity of research on human subjects.

**NRSG 7105. Translating Research Evidence into Practice. (3 Hours)**

Offers opportunities for students to examine strategies and tools for retrieval, compilation, critical appraisal, and application of empirical, reflective, and practice-based information to improve quality of care and health outcomes for populations of interest. Uses systematic reviews, case studies emphasizing use of quality improvement methods, clinical guidelines, collaborative interprofessional practice networks, and information technology. Includes program evaluation strategies and interpretation of biostatistical concepts relevant to population-based advanced practice. Offers students an opportunity to explore techniques that support their professional presence and voice as a leader. This course meets the requirements of the following DNP Essentials of Doctoral Education for Advanced Practice Nursing: (1): Scientific Underpinnings for Practice; (3): Clinical Scholarship and Analytical Methods for Evidence-Based (AACN, 2006).

**NRSG 7110. Evidence-Based Practice Research Application. (2 Hours)**

Offers graduate nursing students an opportunity to work singly or in groups of two with an experienced researcher in an area related to their clinical specialization or other professional interest. The student's individual contribution depends on the stage of the research project and is determined jointly by the student, faculty liaison, and researcher. Evaluation includes the student's individual effort, participation in the collaborative research process, and appraisal of the learning experience as a research assistant. By participating in an established, scientifically significant project, offers students an opportunity to actively experience the "real-life" aspects of conducting research and to be socialized to the role of the researcher.

**Prerequisite(s):** NRSG 7105 with a minimum grade of B

**NRSG 7120. Healthcare Systems Finance. (3 Hours)**

Explores the alignment of financial policy, economics, and healthcare-systems-based quality care delivery for cost-effectiveness, health equity, and improved outcomes. Reviews assessment of internal and external factors related to healthcare costs and reimbursement to optimize evidence-based system effectiveness.

**NRSG 7130. Healthcare Quality and Informatics. (3 Hours)**

Leverages information and communication technologies to provide equitable healthcare delivery. Includes collecting data to support informed decision making; optimizing the management and delivery of safe, efficient, and high-quality healthcare services; and adhering to best practices and professional regulatory standards.

**NRSG 7220. Acute Care Practicum 1 (Adult-Gerontology). (4 Hours)**

Offers the DNP adult-gerontology acute nurse practitioner student an opportunity for experiential integration and synthesis of knowledge and skills for advanced practice. Emphasizes the provision of care to adults across the spectrum, experiencing complex acute and chronic health problems. Focuses on honing history and physical exam skills, making evidence-based decisions regarding ordering labs, imaging and other diagnostic studies, and developing strong clinical-decision making skills, differential diagnosis, and treatment plans.

**Prerequisite(s):** NRSG 6115 with a minimum grade of B ; (NRSG 5117 with a minimum grade of B or NRSG 5117 with a minimum grade of B )

**NRSG 7221. Acute Care Practicum 2 (Adult-Gerontology). (4 Hours)**

Offers the DNP adult-gerontology acute nurse practitioner student an opportunity for experiential integration and synthesis of knowledge and skills for advanced practice. Focuses on the provision of care to adults across the age spectrum, experiencing complex acute and chronic health problems. Emphasizes proficiency in history and physical exam skills, making evidence-based decisions regarding ordering labs, imaging and other diagnostic studies, and developing strong clinical-decision making skills, differential diagnosis, and treatment plans. Examines indications, contraindications, and complications for commonly performed procedural skills.

**Prerequisite(s):** NRSG 7220 with a minimum grade of B

**NRSG 7222. Acute Care Practicum 3 (Adult-Gerontology). (4 Hours)**

Offers the DNP adult acute nurse practitioner student individualized experiences in the roles of practitioner, educator, and manager. Focuses on the synthesis of acquired knowledge and skills proficiency for the advanced practice acute care practitioner. Offers students an opportunity to assume increasing responsibility for overall patient care independently. Emphasizes managing a larger case load, developing care plans, engaging in discharge planning, and coordinating care across disciplines, actively working with, and consulting, specialists.

**Prerequisite(s):** NRSG 7221 with a minimum grade of B

**NRSG 7431. Neonatal Advanced Practicum 1. (4 Hours)**

Offers the opportunity for experiential integration and synthesis of basic knowledge and skills for care of the high-risk neonate and their family. Reinforces the principles of collaborative decision making, effective communication, cultural sensitivity, use of equipment and techniques, evidence-based practice, planning for routine and emergent care, and evaluation of disease processes in the neonate. Provides the opportunity to demonstrate achievement of entry-level assessment and skills, including therapeutic and diagnostic procedures.

**NRSG 7432. Neonatal Advanced Practicum 2. (4 Hours)**

Offers the opportunity for experiential integration and synthesis of basic knowledge and skills for care of the high-risk neonate and their family. Reinforces the principles of collaborative decision making, effective communication, cultural sensitivity, use of equipment and techniques, evidence-based practice, planning for routine and emergent care, and evaluation of disease processes in the neonate. Focuses on the acquisition of the skills necessary to provide direct management of the high-risk neonate and their family while continuing to develop achievement of entry-level assessment and skills including therapeutic and diagnostic procedures with an increasingly complex patient assignment.

**Prerequisite(s):** NRSG 7431 with a minimum grade of B

**NRSG 7433. Neonatal Advanced Practicum 3. (4 Hours)**

Offers the opportunity for experiential integration and synthesis of knowledge and skills for care of the high-risk neonate and their family. Strengthen their abilities in collaboration, clinical decision making, effective communication, cultural sensitivity, use of equipment and techniques, evidence-based practice, planning for routine and emergent care, and evaluation of disease processes in the neonate. Refine entry-level practice assessment and skills including therapeutic and diagnostic procedures as the student prepares for entry into practice.

**Prerequisite(s):** NRSG 7431 with a minimum grade of B ; NRSG 7432 with a minimum grade of B

**NRSG 7440. Adult/Older Adult Gerontology Primary Care Nursing Practicum 1. (4 Hours)**

Offers an opportunity for experiential integration and synthesis of knowledge and skills for advanced practice adult gerontology primary care nursing care concepts. Examines selected topics including advanced pathophysiology, health promotion, diagnostic reasoning, differential diagnosis, and interprofessional healthcare communication, and collaboration. Emphasizes assessment, medical decision-making, and development of best practice in health promotion, health and wellness, treatment and management for diverse clients ages 13 and up including the old-old, and end-of-life care. Direct care hours are completed toward certification eligibility. Offers an opportunity to demonstrate achievement of entry-level advanced practice skills and competencies.

**Prerequisite(s):** (NRSG 5117 with a minimum grade of B or NRSG 5117 with a minimum grade of B ); NRSG 6115 with a minimum grade of B

**NRSG 7441. Adult/Older Adult Gerontology Primary Care Nursing Practicum 2. (4 Hours)**

Offers an opportunity for continued analysis, synthesis, and application of knowledge, skills, and competencies for entry level advanced practice adult gerontology primary care nursing. Applies foundational knowledge and concepts safely in the novice adult gerontology primary care nurse practitioner role while caring for individuals and populations with common acute and chronic care. Provides opportunity to make primary care diagnoses in a primary healthcare setting under direct supervision of a clinical preceptor and a clinical nursing faculty member. Direct care hours are completed toward certification eligibility. Offers an opportunity to demonstrate achievement of entry-level advanced practice skills and competencies.

**Prerequisite(s):** (NRSG 5117 with a minimum grade of B or NRSG 5117 with a minimum grade of B ); NRSG 6115 with a minimum grade of B ; NRSG 6249 with a minimum grade of B ; NRSG 6222 with a minimum grade of B ; NRSG 7440 with a minimum grade of B

**NRSG 7442. Adult/Older Adult Gerontology Primary Care Nursing Practicum 3. (4 Hours)**

Culminates in the synthesis of knowledge, clinical skills, and competencies as an adult gerontology primary care nurse practitioner in an advanced practice nurse role in primary healthcare. Facilitates and focuses on the independent, safe, and accountable role of the adult gerontology primary care nurse practitioner in preparation for entering practice. Offers an opportunity to provide safe, evidence-based quality care to improve outcomes for persons aged 13 and older. Direct care hours are completed toward certification eligibility.

**Prerequisite(s):** (NRSG 5121 with a minimum grade of B or NRSG 5121 with a minimum grade of B ); (NRSG 5118 with a minimum grade of B or NRSG 5118 with a minimum grade of B ); NRSG 6253 with a minimum grade of B ; NRSG 7105 with a minimum grade of B ; NRSG 7441 with a minimum grade of B

**NRSG 7480. Advanced Psychiatric Nursing Practicum 1. (4 Hours)**

Offers an opportunity for experiential integration and synthesis of knowledge and skills for advanced practice psychiatric nursing care. Covers selected topics including psychopathology, mental health, psychodiagnostics, differential diagnoses, and therapeutic alliance building. Emphasizes psychotherapy and psychopharmacology treatments for diverse clients across the lifespan. Direct care hours are completed toward certification eligibility. Offers an opportunity to demonstrate achievement of entry-level advanced practice skills.

**Prerequisite(s):** NRSG 6281 with a minimum grade of B ; NRSG 6282 with a minimum grade of B ; NRSG 6283 with a minimum grade of B ; NRSG 6286 with a minimum grade of B

**NRSG 7481. Advanced Psychiatric Nursing Practicum 2. (4 Hours)**

Offers an opportunity for continued synthesis of knowledge and application of theoretical concepts and skills for advanced practice nursing care. Emphasizes psychotherapy and psychopharmacology treatments for diverse clients across the lifespan. Direct care hours are completed toward certification eligibility. Offers an opportunity to enhance advanced practice skills through increased clinical experiences.

**Prerequisite(s):** NRSG 7480 with a minimum grade of B

**NRSG 7482. Advanced Psychiatric Nursing Practicum 3. (4 Hours)**

Enhances the synthesis of acquired knowledge and proficiency in interventions for advanced practice psychiatric nursing care. Emphasizes high-quality care, and improving outcomes for diverse clients across the lifespan. Direct care hours are completed toward certification eligibility. With continued guidance, offers students an opportunity to assume increasing responsibility for care of clients and families.

**Prerequisite(s):** NRSG 7481 with a minimum grade of B

**NRSG 7500. Role/Practice Issues in Advanced Practice Nursing. (3 Hours)**

Analyzes new developments and current trends in advanced practice, education, and research. Includes the historical, legal, legislative, and professional role issues associated with advanced practice specialty nursing. Emphasizes professional responsibilities, ethical issues, diversity, cultural competency, quality assurance, continuing education, and professional involvement. Focuses on the historical events that have impacted the development of both the profession and the organizational structure of the professional organizations: American Association of Nurse Anesthetists, American Nurses Association, and the American Nurses Credentialing Center. Discusses professional standards established by these organizations. Reviews other agencies, at the federal and state levels, that affect the legal recognition of advanced practice. Presents an overview of the educational accreditation process and certification.

**NRSG 7503. Pharmacotherapeutics in Anesthesia and Critical Care Nursing. (3 Hours)**

Designed to help the DNP student in anesthesia develop an understanding of the pharmacologic principles and associated application to clinical anesthesia and critical care advance practice nursing. Reviews the basic principles of the pharmacokinetics and pharmacodynamics of commonly used drugs in anesthesia and critical care. The prescription, administration, and monitoring of medications for the critically ill and patients undergoing anesthesia serves as the organizing framework for the course. Content includes the most common agents and classes of drugs prescribed for the critically ill and patients undergoing anesthesia, the signs and symptoms of drug toxicity, and interventions utilized to resolve adverse drug reactions.

**Prerequisite(s):** NRSG 5117 with a minimum grade of B or NRSG 5117 with a minimum grade of B

**NRSG 7506. Applied Chemistry, Physics, and Cardiopulmonary Physiology of Anesthesia. (3 Hours)**

Designed to help the DNP student in anesthesia to integrate nursing science with basic biophysical sciences and to prepare for the highest level of advanced nursing practice in the specialty of anesthesia. Offers students an opportunity to correlate biochemical and physics principles as they apply to the physiology, pathophysiology, and pharmacology of anesthesia nursing. Also provides in-depth discussion and integration of the knowledge related to the principles of chemistry, physics, and pharmacology of general anesthesia. Emphasizes the physiological mechanisms related to operation and regulation of the cardiopulmonary system. Discusses physiological information mostly related to anesthesia.

**NRSG 7509. Advanced Concepts in Nurse Anesthesia Practice. (3 Hours)**

Focuses on the pharmacodynamic, pharmacokinetic, and physiologic principles related to the delivery of anesthetics and adjunctive drugs in advanced nurse anesthesia practice. Emphasizes pharmacologic management of patients with complex health problems, including multisystem failure and multidrug therapy. Studies anesthetic management for extensive surgeries performed on adults and children to develop safe intra-operative and perioperative care plans. Covers integration of pharmacological data, anesthesia administration, monitoring technology, and comprehensive advanced nursing care to return patients to their optimal state of health. Includes an overview of pain and regional anesthesia with an emphasis on anesthetic indications, management, and complications. Presents fundamental principles governing obstetrical anesthesia, emphasizing normal physiological changes associated with pregnancy, anesthetic considerations, complications inherent in pregnancy, and approaches to anesthesia.

**Prerequisite(s):** NRSG 7503 with a minimum grade of B ; NRSG 7540 (may be taken concurrently) with a minimum grade of B

**NRSG 7511. Applied Gross Anatomy and Physiology of Anesthesia. (3 Hours)**

Designed to help the DNP student in anesthesia to develop the fundamental knowledge and skills necessary for entry into advanced practice anesthesia nursing. Emphasizes study of the head and neck (multiorgan systems including the nervous system) and the back, including the spinal cord, the thorax (with focus on the respiratory and cardiovascular systems), the abdomen, pelvis, and extremities. Companion laboratory periods, during which students examine the same region in a prospected human cadaver, follow lectures. Presents ultrasound, radiography, computer tomograms (CT scans), and magnetic resonance images (MRIs) of normal and diseased organs in lectures and labs to emphasize the importance of integrating the principles of anatomical knowledge in understanding the human body in health and disease.

**NRSG 7520. Conceptual Basis of Nurse Anesthesia Practice 1. (3 Hours)**

Aims to help the DNP student in anesthesia to develop the fundamental knowledge and skills necessary for entry into advanced practice anesthesia nursing. Areas of focus include patient assessment, essential anesthesia techniques, monitoring and equipment, pharmacologic interventions, development of case/disease-specific anesthesia management plans, cultural competence, and safe practice across the life span. This is the first course in the nurse anesthesia program conceptual basis of practice clinical series.

**Prerequisite(s):** NRSG 7105 with a minimum grade of B

**NRSG 7523. Conceptual Basis of Nurse Anesthesia Practice 2. (3 Hours)**

Aims to help the DNP student in anesthesia to develop foundational skills in the management of highly specialized problems and conditions requiring anesthesia or surgical interventions. Key concepts include patient assessment, evaluation, and differential diagnosis. Offers students an opportunity to demonstrate the ability to plan and implement anesthesia care and pharmacologic interventions for patients with disorders of the cardiovascular and pulmonary systems across the life span. This is the second course in the nurse anesthesia program conceptual basis of practice clinical series.

**Prerequisite(s):** NRSG 7520 with a minimum grade of B

**Corequisite(s):** NRSG 7533

**NRSG 7526. Conceptual Basis of Nurse Anesthesia Practice 3. (3 Hours)**

Designed to help the DNP student in anesthesia engage in integration of the knowledge and skills associated with highly specialized problems and conditions requiring anesthesia or surgical interventions. Offers students an opportunity to demonstrate the ability to conduct well-informed discussion concerning physiology and pathophysiology of the nervous, endocrine, renal, and hepatic systems. Key competencies include conducting focused assessment, anesthetic planning, and selection of pharmacologic interventions for patients with disorders of the nervous, endocrine, renal, and hepatic systems across the life span. This is the third course in the nurse anesthesia program conceptual basis of practice clinical series.

**Prerequisite(s):** NRSG 7523 with a minimum grade of B

**Corequisite(s):** NRSG 7536

**NRSG 7530. Nurse Anesthesia Practicum 1. (3 Hours)**

Offers the DNP student in anesthesia an opportunity for experiential integration and synthesis of basic knowledge and skills for anesthesia nursing care. Selected topics and clinical case plans reinforce the principles of collaborative decision making, effective communication, cultural sensitivity, use of equipment and techniques, use of evidence, planning for routine and emergent events, and evaluation of various conditions for patients across the life span. Students have an opportunity to demonstrate achievement of entry-level practice skills by the end of the course.

**NRSG 7533. Nurse Anesthesia Practicum 2. (3 Hours)**

Offers the DNP student in anesthesia an opportunity to apply theoretical concepts and skills obtained in the lab to the clinical setting. With supervision, students create a plan of care for induction, maintenance, emergence, and postanesthesia. Offers students an opportunity to enhance these skills through clinical experiences, lab skills development, and seminar discussions.

**Prerequisite(s):** NRSG 7530 with a minimum grade of B

**Corequisite(s):** NRSG 7523

**NRSG 7536. Nurse Anesthesia Practicum 3. (4 Hours)**

Aims to help the DNP student in anesthesia to refine and enhance their growing anesthesia knowledge and skill. Students progress under supervision at clinical sites to more independent management of basic cases and begin exposure to complex and specialty cases. Seminars meet to discuss issues related to complex clinical practice with emphasis on patients with cardiac disease, cardiac anesthesia, management of critically ill patients, glycemic management, blood management, coagulation management, cerebral oximetry, and renal protection.

**Prerequisite(s):** NRSG 7533 with a minimum grade of B

**NRSG 7540. Advanced Clinical Experiences in Nurse Anesthesia 1. (1 Hour)**

Aims to help the DNP student in anesthesia to begin development of advanced skills and to integrate comprehensive cumulative knowledge into anesthesia and perioperative care for complex patients having major and specialty surgery across the life span. Focuses on patient-centric care and includes development of an understanding of how nurse anesthetists can deliver high-quality care to improve patient outcomes and the safety environment adherence to individual and systemic safety processes. Students incorporate didactic knowledge into developing anesthesia management plans for patients across the acuity and age continuum. With continual guidance, offers students an opportunity to assume increasing responsibility for more care of increasingly complex patients and surgical procedures.

**NRSG 7543. Advanced Clinical Experiences in Nurse Anesthesia 2. (2 Hours)**

Mentors students to develop skills in crisis management, patient safety, and independent anesthetic management. The role of the senior SRNA demands demonstration of leadership, interprofessional communication, collaboration, and use of resources in all settings and situations, including crisis events. Students integrate information from prior classroom and clinical experiences into individualized plans of care for all ages and complexity of patients.

**Prerequisite(s):** NRSG 7540 with a minimum grade of B

**NRSG 7546. Advanced Clinical Experiences in Nurse Anesthesia 3. (2 Hours)**

Aims to help the DNP student in anesthesia to utilize knowledge and skill gained during increasingly complex clinical experiences to refine the skills necessary to function as an independent professional clinician and member of the healthcare system. Designed to support integration and synthesis of advanced knowledge and skills for interdisciplinary anesthesia nursing care of patients across the life span who have complex health problems and who are undergoing a wide range of surgical procedures. Selected topics and clinical case studies focus on higher-level professional skills, including collaborative decision making, utilization of evidence to inform practice, and effective communication. With minimal guidance, students assume greater responsibility in planning, implementing, and evaluating anesthesia care.

**Prerequisite(s):** NRSG 7543 with a minimum grade of B

**NRSG 7700. The Science of Nursing. (3 Hours)**

Introduces basic concepts in the philosophy of science and the development of knowledge. Explores the historical development and themes for knowledge building in nursing and healthcare. Offers students an opportunity to analyze different ways of knowing and world views as they relate to the development of programs of research in nursing and their area of research interest. Examines scientific literature, identification of gaps in knowledge, and the development of research questions to begin the process of developing a research plan.

**NRSG 7705. Theoretical and Conceptual Foundations in Nursing Science. (3 Hours)**

Examines the nature of nursing science by critically analyzing the current relevance of nursing theories and conceptual models to the advancement of nursing's scientific development. Emphasizes various approaches to concept/theory development, analysis, and synthesis. Offers students an opportunity to develop skills in concept/theory analysis and synthesis, applying a formal analysis of concept relevant to their area of interest. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** NRSG 7700 (may be taken concurrently) with a minimum grade of C-

**NRSG 7709. Qualitative Research Methods. (3 Hours)**

Examines published qualitative research in nursing and related disciplines. Emphasizes major strategies of qualitative inquiry including ethnography, grounded theory, phenomenology, narrative inquiry, and case study. Offers students an opportunity to begin to develop mastery in critiquing qualitative research, ethical issues, data analysis techniques, and proposal development.

**Prerequisite(s):** NRSG 7700 with a minimum grade of B

**NRSG 7712. Quantitative Research Methods. (3 Hours)**

Introduces different types of quantitative research methods as they relate to investigation of phenomena in nursing and healthcare. Begins with a focus on defining research problems, theory testing, and causal inference, then explores a range of research designs and methodologic techniques that are available for empirical research. Includes quantitative techniques such as sampling, data collection, analysis, and interpretation.

**Prerequisite(s):** NRSG 7700 with a minimum grade of B

**NRSG 7715. Measurement in Clinical Research. (3 Hours)**

Examines the concepts of measurement, sources of measurement error, control, and instrumentation as they relate to variables in clinical research. Students have an opportunity to explore the procedural aspects of measurement, criterion-referenced and norm-referenced measures, as well as the reliability and validity of measurement techniques. Discusses methods and statistical procedures used in instrument design and testing, such as instrument blueprints, factor analysis, and item response theory. Emphasizes the measurement of variables to evaluate the effectiveness of clinical interventions.

**Prerequisite(s):** NRSG 7700 with a minimum grade of B

**NRSG 7750. Healthcare of Urban Populations. (3 Hours)**

Offers students an opportunity to explore the body of urban health research to identify key themes, conceptual foundations, and contemporary research findings. Examines integration of cultural and community contextual factors that affect the health status of urban populations. These include racial, ethnic, and economic health disparities; influences of the urban physical environment and the urban social environment; and the availability of and access to health and social services. Studies the influence of concepts such as vulnerability, underserved, culture, ethnicity, poverty, discrimination, disparities in healthcare, urbanization, diversity, social determinants of health, environmental justice, and migration on health status.

**NRSG 7755. Intervention Research: Development, Implementation, and Evaluation. (3 Hours)**

Examines theory-based intervention research for individuals, groups, populations, and systems. Offers an overview of the types of theory-based interventions across the health spectrum. Reviews the development and testing of theory-based interventions. Emphasizes understanding the strengths and challenges of integrating technology across the development, testing, and implementation of a theory-based intervention. Also emphasizes the selection of existing interventions, the process of adaption, and the valid and reliable execution of the selected theory-based intervention by examining such issues as treatment, fidelity, intervention duration, context, and interventionist expertise. Compares and contrasts intervention research developed for efficacy, effectiveness, and implementation. Restricted to students enrolled in a PhD program or with permission of instructor.

**Prerequisite(s):** NRSG 7705 (may be taken concurrently) with a minimum grade of C- ; NRSG 7709 (may be taken concurrently) with a minimum grade of C-

**NRSG 7770. Research Colloquium. (1 Hour)**

Offers doctoral students an opportunity to explore in-depth key concepts in nursing and healthcare research. Led by a faculty expert, offers students an opportunity to engage in meaningful dialogue and analysis to examine the concept from multiple perspectives. May be repeated up to four times.

**NRSG 7900. Leadership of Healthcare Systems Change. (3 Hours)**

Focuses on leadership strategies essential for systemic change within practice settings and healthcare organizations. Emphasizes understanding healthcare systems, strategic planning, policy development, and transformative leadership practices.

**NRSG 7911. DNP Project Immersion 1. (1 Hour)**

Provides individualized mentorship for the application of knowledge and competencies to guide the formulation of a scholarly project to completion. Focuses on problem identification, project scope and methodology, IRB approval, and data collection strategies.

**NRSG 7912. DNP Project Immersion 2. (1 Hour)**

Provides individualized mentorship for the application of knowledge and competencies to progress scholarly project to completion. Focuses on individualized project data analysis and statistical review, exploration of study findings and strategies for dissemination. Guides the scholarly project towards completion of review of findings, implications for clinical practice and scholarly dissemination.

**NRSG 7919. Translation of Research for Evidence-Based Practice. (3 Hours)**

Applies basic principles of the research process to appraise and synthesize the literature and other data sources for development and implementation of informed, patient-centered, evidence-based practice change. Integrates processes that support the ethical conduct of scholarly activities to mitigate potential risks to participants.

**NRSG 7920. The Steps to Practice Inquiry: Analyze, Evaluate, Synthesize, and Apply the Evidence. (3 Hours)**

Designed as a complement to NRSG 7105 or equivalent. Offers students an opportunity to obtain skills and competencies needed for a practice doctorate—ability to generate new knowledge from practice, evaluate current practice approaches, analyze current knowledge, and adapt/translate knowledge into usable clinical strategies that improve practice and lead to better outcomes.

**NRSG 7921. DNP Scholarly Project 1: Design and Ethical Consideration of Practice Application. (3 Hours)**

Reflects the culmination of practice inquiry, knowledge, and competencies attained during the Doctorate of Nursing Practice program. In this seminar, students are mentored through the process of evidence-based project development, including formulation of goals and objectives; refinement of project design and implementation strategies; and development of tools and/or forms for data collection, identification of resources (personnel and fiscal), ethical review, and evaluation. Offers students an opportunity to participate in a process of peer consultation and critique in support of project refinement. Requires a minimum total of 250 scholarly practice hours.

**Prerequisite(s):** NRSG 7920 with a minimum grade of B

**NRSG 7922. DNP Scholarly Project 2: Applying Practice Knowledge—Implementation/Outcomes. (3 Hours)**

Reflects the culmination of practice inquiry, knowledge, and competencies attained during the Doctorate of Nursing Practice program. In this seminar, students are guided through the process of completing an evidence-based project. Emphasizes the acquisition of reflective practice skills and competencies needed to assess and implement evaluation of evidence and outcomes. Requires a minimum total of 250 scholarly practice hours.

**Prerequisite(s):** NRSG 7921 with a minimum grade of B

**NRSG 7923. DNP Scholarly Project 3: Dissemination of Practice Inquiry. (3 Hours)**

Reflects the culmination of practice inquiry, knowledge, and competencies attained during the Doctorate of Nursing Practice program. In this seminar, students are guided through the process of summarizing and disseminating the results of the project. Requires a minimum total of 250 scholarly practice hours.

**Prerequisite(s):** NRSG 7922 with a minimum grade of B

**NRSG 7924. Applied Epidemiology for Advanced Nursing. (3 Hours)**

Examines the scientific foundations integral to the competencies outlined in the Essentials of Doctoral Education for Advanced Nursing Practice (2006). Course content and accompanying practice opportunities, grounded in clinical prevention and population health, seek to enable students to analyze epidemiological, biostatistical, occupational, and environmental data in the development, implementation, and evaluation of clinical prevention and population health. Emphasizes current concepts of public health, health promotion, evidence-based recommendations, determinants of health, environmental/occupational health, and cultural diversity and sensitivity needed to guide advanced nursing practice. In addition, emerging knowledge regarding infectious diseases, emergency/disaster preparedness, and intervention frame the exercises and practice opportunities focused on clinical prevention and population health.

**Prerequisite(s):** NRSG 7100 (may be taken concurrently) with a minimum grade of B

**NRSG 7925. Health Policy and Advocacy. (3 Hours)**

Examines the scientific foundations integral to meeting the competencies outlined in the Essentials of Doctoral Education for Advanced Nursing Practice (2006). Offers students an opportunity to obtain the knowledge and to develop the skills and competencies essential to assuming leadership roles in the development of health policy. Contrasts the major contextual factors and policy triggers that influence health policymaking at the various levels. Exercises are aimed at developing skill in the design, implementation, and advocacy for healthcare policy to address issues of social justice and equity in healthcare. Integrates practice experiences with two additional skill sets—the ability to analyze the policy process and the ability to engage in politically competent action.

**Prerequisite(s):** NRSG 7100 with a minimum grade of B

**NRSG 7926. Applied Data Management. (2 Hours)**

Studies the application and use of quantitative and qualitative statistical methods including inferential statistics. Focuses on accurate analysis and interpretation of research designs and statistical tests relevant to types of variables and levels of measurement utilizing selected quantitative and qualitative statistical software. Reviews basic application of selected spreadsheets and proper use of tables and figures for accurate data and outcome reporting.

**NRSG 7976. Directed Study. (1-4 Hours)**

Allows PhD students to develop an individual plan to attain specific knowledge related to research goals or specific research technique/approach. May consist of library study and reading, preparation of scholarly presentation or publication, mentored research experience, or other appropriate activity as approved by professor and academic advisor. May be repeated without limit.

**NRSG 7990. Thesis. (1-4 Hours)**

Allows students to implement a research proposal with the guidance of a thesis adviser. Requires data collection and analysis, writing the thesis, and presentation of the findings. May be repeated up to three times.

**NRSG 8960. Exam Preparation—Doctoral. (0 Hours)**

Offers the student the opportunity, under faculty supervision, to prepare for the PhD qualifying exam.

**NRSG 8984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated up to four times.

**NRSG 8986. Research. (0 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**NRSG 9000. Comprehensive Exam. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**NRSG 9845. Dissertation Seminar 1. (3 Hours)**

Guides students through the beginning of the research process as they prepare their dissertation proposals, including writing the literature review and outlining the research design for their projects. Students have an opportunity to work with their dissertation advisors both individually and in small groups.

**Prerequisite(s):** NRSG 7700 with a minimum grade of B

**NRSG 9846. Dissertation Seminar 2. (3 Hours)**

Provides students with an opportunity to finalize their dissertation proposals and make the necessary arrangements to begin their investigations by completing the design and methods and obtaining Investigative Review Board approval. Students have an opportunity to work with their dissertation advisors both individually and in small groups.

**Prerequisite(s):** NRSG 9845 with a minimum grade of B

**NRSG 9984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**NRSG 9986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**NRSG 9990. Dissertation Term 1. (0 Hours)**

Offers research/experimental work for PhD thesis on a full-time basis. Restricted to Doctoral candidacy students only.

**Prerequisite(s):** NRSG 9000 with a minimum grade of S

**NRSG 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** NRSG 9990 with a minimum grade of S

**NRSG 9996. Dissertation Continuation. (0 Hours)**

Offers continuation of PhD dissertation research.

**Prerequisite(s):** NRSG 9991 with a minimum grade of S or Dissertation Check with a score of REQ

**Nutrition - CPS (NTR)****NTR 6100. Advanced Nutrition and Metabolism. (4 Hours)**

Examines the metabolism, physiological actions, and interrelationships of carbohydrates, protein, fats, vitamins, minerals, and water. Discusses the regulation of the biochemical pathways and the nutritional principles of macronutrient and micronutrient metabolism; absorption, excretion, transport, and cellular metabolism; nutritional and toxicological standards for humans and animal models; and bioavailability of minerals.

**NTR 6101. Nutrition Program Planning. (3 Hours)**

Focuses on individual and community nutritional assessment. Emphasizes development, implementation, and evaluation of nutrition intervention programs. Offers students an opportunity to practice setting realistic goals that produce outcomes that improve health and support wellness. Explores changing nutritional behavior and the barriers to such change. This course is intended for graduate students in nutrition or other health sciences and/or human services graduate students interested in developing, implementing, and evaluating community-based nutrition programs.

**NTR 6105. Foundations of Integrative Health. (4 Hours)**

Introduces the foundational concepts and tools within integrative health and wellness. Integrative health is centered around an ecosystem of relationships, strategies, and tools. Focuses on the unique characteristics of the mind, body, spirit, and environment and their interplay. Offers students an opportunity to obtain an understanding of the impact that culture and belief systems have on wellness practices and to appreciate that people are active partners in healing. Seeks to help empower students to engage fully with opportunities to cultivate resilience and foster holistic well-being.

**NTR 6110. Medical Nutrition Therapy. (4 Hours)**

Explores the application of nutrition principles to the treatment and prevention of diseases. This treatment can range from changes in diet to providing specialized therapies such as intravenous or tube feeding. Discusses lifestyle strategies and therapeutic nutrient intervention to correct nutritional insufficiencies; promote optimal health; and prevent, manage, or correct medical problems.

**Prerequisite(s):** NTR 6100 with a minimum grade of C-

**NTR 6112. Research Methods in Nutrition. (4 Hours)**

Examines the varying techniques and methods used in nutritional research. Offers students an opportunity to learn how to critically analyze and interpret research literature.

**NTR 6115. Health Promotion/Disease Prevention. (4 Hours)**

Examines health promotion—the science and art of helping people change their lifestyle to move toward a state of optimal health. Lifestyle changes can prevent chronic diseases, such as heart disease, cancer, and diabetes, which are the leading causes of death and disability in the United States. Reviews and critically assesses current efforts to influence lifestyle change, at both the individual and population levels. Offers students an opportunity to plan, organize, and conduct lifestyle change programs.

**NTR 6118. Clinical Health Behavior Change. (4 Hours)**

Explores health behavior theories to facilitate the adoption of healthful behaviors to various groups. Includes motivational interviewing; practice of nonverbal, active listening; goal assessment; and group counseling. Explores the evaluation of nutrition education interventions.

**NTR 6120. Healthy Aging: Nutrition Strategies for Optimal Longevity. (4 Hours)**

Offers a general survey of the impact of aging on the nutritional status of older adults. Covers the relationship between nutrition, body composition, and activity level and their impact on rehabilitation of older adults. Encourages students to look for the clinical signs and symptoms in aging clients that may require nutritional interventions. Offers students an opportunity to acquire strategies for the treatment and prevention of diseases and conditions that are associated with aging and become familiar with various cultures known for their longevity.

**NTR 6125. The Process of Health and Healing: Exploring Systems in the Body—Part 1. (4 Hours)**

Focuses on applying research to understand the process of health and healing. Recognizes that each person's body is its own unique ecosystem and the path toward health and wellness may differ for each individual. Examines the phenomenon of epigenetics and helps students understand that genetic makeup is not the only factor in the expression of health and wellness. Explores the systems of the body and how to identify factors that may interfere with the healing process or disrupt individual well-being. Explores the metabolic, endocrine, and cardiovascular systems, among others.

**Prerequisite(s):** NTR 6105 with a minimum grade of C-

**NTR 6130. Healthcare and Nutrition Communication. (4 Hours)**

Examines cutting-edge research and current theories in health and nutrition communication. Studies empirically proven health campaigns, offering students an opportunity to understand the key qualities of messages that can best influence health-related decision making. Analyzes the mechanisms for transmitting key knowledge to a target audience, including the potential utility of social networking tools in developing nutrition as an applied science. Offers students an opportunity to test their own messages using print and electronic media. Seeks to help nutrition scientists create communities of "healthy practice" among populations that would benefit the most from improved nutrition.

**NTR 6135. The Process of Health and Healing: Exploring Systems in the Body—Part 2. (4 Hours)**

Offers an advanced exploration of the process of health and healing and a continued examination of various systems in the body, including the immune, gastrointestinal, and nervous systems. Leverages this knowledge to consider the range of evidence-based practices influencing various health and wellness outcomes.

**Prerequisite(s):** NTR 6125 with a minimum grade of C-

**NTR 6148. Exercise Physiology. (3 Hours)**

Covers the advanced study of concepts, principles, and research in the field of exercise physiology. Discusses advanced concepts in the muscular/neuromuscular, cardiovascular, ventilatory, endocrine, and metabolic responses to exercise and exercise training. Specific study of the physiological control mechanisms regulating these systems are also addressed during periods of rest, acute exercise, and following chronic exercise training.

**NTR 6150. Sports Psychology. (3 Hours)**

Covers topics such as eating disorders among athletes, female athlete triad, and weight management. Discusses performance enhancement, motivation, and stress management of athletes. Offers students an opportunity to develop skills to counsel athletes, as well as sports teams, and to develop an understanding of behavioral change theory as it relates to sports psychology.

**NTR 6155. Nutrition Entrepreneurship. (3 Hours)**

Includes advanced analysis of the problems and considerations involved in establishing, organizing, and operating a nutrition-based business or clinical nutrition practice. Focuses on tools, techniques, and resources necessary for establishing a business, including developing a business plan, marketing and advertising, and reimbursement and legal and regulatory matters.

**NTR 6165. Food and Society. (4 Hours)**

Covers healthy food trends and food products that affect how we live. Includes advanced analysis of food in our society and environment. Examples are the organic movement, product and meal trends in supermarkets and restaurants, food and the economy, food politics, food labeling, and culinary nutrition trends. Focuses on how one can implement the findings into one's practice and/or area of expertise.

**NTR 6200. Nutrition Education. (4 Hours)**

Presents methods for creating and evaluating nutrition content for educational presentations. Offers students an opportunity to develop educational materials with an eye toward audience and context-appropriate language. Encourages students to reflect on the purpose of particular educational materials and then fashion nutrition messages that have the best chance of eliciting meaningful behavioral changes. Requires students to produce highly effective educational materials from start to finish and, in the process, practice the commonly used methods for writing, editing, and designing appropriate educational tools.

**NTR 6201. Commercialization of Nutrition and Nutritional Information. (3 Hours)**

Examines the commercialization of food from the perspectives of the marketers and consumers. In the United States, the consumption of food and nutritional information is mediated by advertisements and infomercials. In contemporary society, the market shapes what we eat and what we think that we should eat. This course offers students an opportunity to evaluate the role that commercial enterprises play in influencing notions of healthy nutrition and nutrition education. Features images and copy found in print advertisements, television, popular online sources, and movies and product placements.

**NTR 6202. The Financing of Nutrition and Wellness. (3 Hours)**

Assesses the impact that public and private funding has on health communication and nutrition campaigns. In the United States, health campaigns are determined, in part, by the funding that they receive. Unfortunately, private and public funding of healthcare has traditionally embraced a pathological model, one in which payment was driven by curing the sick rather than maintaining the healthy. With a greater focus on controlling healthcare costs, policymakers, employers, and insurance companies have sought to promote health through nutritional information and wellness programs. The challenge is to find ways of financing these efforts. Offers students an opportunity to develop policy recommendations for supporting better nutrition practices among a diverse population.

**NTR 6866. Applied Research in Nutrition. (1-4 Hours)**

Offers graduate students in applied nutrition an opportunity to obtain experience in the formal presentation of research results. Emphasizes the components of quality research. Offers students an opportunity to conduct, analyze, and present an evaluative or applied research project in a clear, concise, and logical manner.

**Prerequisite(s):** NTR 6112 (may be taken concurrently) with a minimum grade of C-

**NTR 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**NTR 7130. Overweight and Obesity 1. (4 Hours)**

Addresses the epidemiology of obesity, as well as the etiology and possible causes. Discusses the medical management and complications of obesity in-depth. Students review and critically assess current treatment strategies, such as pharmacotherapy, bariatric surgery, and behavioral approaches. Considers new research and paradigms for the causes and treatment of obesity.

**NTR 7132. Overweight and Obesity 2. (4 Hours)**

Examines a variety of topics in the current literature, some controversial, related to the etiology, management, treatment, and psychosocial ramifications of obesity. Offers students an opportunity to conduct an extensive review of the existing literature on various topics connected with obesity. The goal is to critically analyze and draw conclusions on how particular topics affect certain key areas in obesity, including clinical management, health promotion and disease prevention, and policy, as well as individual perceptions.

**Prerequisite(s):** NTR 7130 with a minimum grade of C-

**NTR 7135. Eating Disorders in Children and Adults. (4 Hours)**

Examines eating disorders in children and adults, including the definition and clinical presentation of eating disorders. Considers the medical complications of eating disorders, as well as the relationship between eating disorders and obesity. Examines family issues, especially for children and adolescents, in the etiology and treatment of eating disorders. Analyzes existing approaches to treatment, as well as new and experimental treatments.

**NTR 7147. Sports and Fitness Nutrition. (3 Hours)**

Focuses on understanding the specific role of energy and nutrients in fitness and athletic performance. Additional topics include the role of fluid and electrolytes, ergogenic aids, and special diets in physical activity. Explores tools for assessing body composition (body fat, muscle mass), unique dietary concerns across the life span and in special population groups (heart disease, diabetes, obesity), and the effect of diet on endurance.

**NTR 7880. Wellness in Practice. (1-4 Hours)**

Presents a guided experience that offers students an opportunity to link theory and practice. Students gain experience in the field of nutrition, integrative health, and wellness, either in-person or online, and develop or work on an established project or program that is relevant to the student's specialization. Seeks to help students construct a "portfolio" piece that can be included in job application packages and applied in their place of practice.

**NTR 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**Operations Research (OR)****OR 6205. Deterministic Operations Research. (4 Hours)**

Introduces the theory, computation, and application of deterministic models to represent industrial operations. Includes linear programming formulation and solution using spreadsheet and algebraic languages software; simplex, big-M, two-phase, revised simplex, and dual simplex algorithms for solving linear programs; introduction to the theory of simplex, fundamental insight, duality, and sensitivity analysis; transportation, assignment, and transshipment problems; shortest path, minimum spanning tree, maximum flow, minimum cost network flow problems and project networks; and discrete-state and continuous-state dynamic programming models and applications. Requires knowledge of linear algebra.

**OR 6500. Metaheuristics and Applications. (4 Hours)**

Focuses on solving large combinatorial optimization problems. Metaheuristic search aims to find a "very good" solution that satisfies the problem constraints. Describes multiple metaheuristic search methods such as simulated annealing (SA), tabu search (TS), genetic algorithms (GA), particle swarm optimization (PSO), and multiobjective methods. Uses algorithms to find values of discrete and/or continuous variables that optimize a system's performance. Discusses the application of metaheuristics to a variety of different problems, including hub location allocation, parallel machine scheduling, travelling salesman problem (TSP), curve fitting, clustering, n-queen, min one, etc. Incorporates practical experiments to demonstrate the advantages and disadvantages of metaheuristic search methods for different applications.

**Prerequisite(s):** OR 6205 with a minimum grade of C-

**OR 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**OR 7230. Probabilistic Operation Research. (4 Hours)**

Introduces the theory and use of stochastic models to represent industrial operations. Topics include discrete-state Markov chains and applications, state transitions and properties, first passage probabilities, steady-state analysis; absorbing chains and absorption probabilities; introduction to continuous-time Markov chains, transition rates and steady-state analysis; basic elements of queuing systems, birth-and-death process, and special cases; steady-state analysis of simple queuing models including M/M/s, M/M/s/K, M/M/s/N/N and their special cases; and queuing models involving nonexponential distributions.

**Prerequisite(s):** IE 6200 with a minimum grade of C or MATH 7241 with a minimum grade of C

**OR 7235. Inventory Theory. (4 Hours)**

Considers the nature and characteristics of inventory systems. Examines techniques of constructing and analyzing mathematical models of inventory systems with a view toward determining operating policies for such systems.

**Prerequisite(s):** OR 6205 with a minimum grade of C

**OR 7240. Integer and Nonlinear Optimization. (4 Hours)**

Covers important families of mathematical programming problems and optimization methods. Discusses the cutting plane and the branch and bound algorithm for binary and mixed integer programming problems. Introduces nonlinear programming including unconstrained optimization, the Kuhn-Tucker conditions, gradient methods, and separable, quadratic, and geometric programming.

**Prerequisite(s):** OR 6205 with a minimum grade of C

**OR 7245. Network Analysis and Advanced Optimization. (4 Hours)**

Considers concepts of advanced linear programming and network flows. Includes theory of the simplex method, the revised simplex algorithm using LU factorization, and simplex for bounded variables and primal-dual methods; methods for solving large-scale models such as Danzig-Wolfe decomposition, Bender's partitioning, Lagrangian relaxation, and subgradient optimization; computational complexity and Karmarkar's algorithm; minimum cost network flows, network simplex, and generalized and multicommodity network flow problems; and special types of network problems including the traveling salesman, routing, network location, and reliability problems.

**Prerequisite(s):** OR 6205 with a minimum grade of C

**OR 7270. Convex Optimization and Applications. (4 Hours)**

Studies convex optimization, a branch of optimization techniques that deals with convex problems. Convex optimization problems appear in many real-world applications and at the same time are theoretically very interesting. Offers students an opportunity to obtain the skills required for solving convex problems and using techniques of convex analysis in solving nonconvex problems. Covers convex analysis, convex optimization problems, second-order cone programming, semidefinite programming, optimality conditions and duality theory, convex geometric problems, theory of computational complexity and convergence rate of algorithms, interior point methods, and relaxations and approximation algorithms. Applications include convex optimization, nonconvex quadratic optimization, combinatorial and network optimization problems, and optimal control problems.

**Prerequisite(s):** OR 6205 with a minimum grade of C-

**OR 7310. Logistics, Warehousing, and Scheduling. (4 Hours)**

Explores the determination of needs and requirements for logistics within large-scale manufacturing and business environments. Examines warehousing and scheduling in the context of a business logistics system. Introduces managerial, mathematical, and software tools and techniques for modeling and optimizing various aspects of the business supply chain. Considers approaches to examining warehousing operations and the associated algorithms.

**Prerequisite(s):** (IE 6200 with a minimum grade of C or MATH 7241 with a minimum grade of C); OR 6205 with a minimum grade of C

**OR 7374. Special Topics in Operations Research. (4 Hours)**

Offers topics of interest to the staff member conducting this class for advanced study. May be repeated up to 2 times for a maximum of 12 semester hours.

**OR 7945. Master's Project. (4 Hours)**

Offers theoretical or experimental work under individual faculty supervision.

**OR 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**OR 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**OR 7990. Thesis. (4 Hours)**

Offers analytical and/or experimental work conducted under the direction of the faculty in fulfillment of the requirements for the degree.

**Prerequisite(s):** OR 7945 with a minimum grade of C-

**OR 7996. Thesis Continuation - Half-Time. (0 Hours)**

Continues thesis work conducted under the supervision of a departmental faculty member.

## Organizational Behavior (ORGB)

**ORGB 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ORGB 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ORGB 3201. Organizational Behavior. (4 Hours)**

Provides an overview of the actions and behaviors of people in organizations. Uses case studies, videos, experiential exercises, lectures, and discussions to explore the effects of individual, interpersonal, group, organizational, and cross-cultural factors on human behavior. Topics include groups and teams, motivation, leadership, organizational change, organizational culture, structure, conflict resolution, and communication. Both the underlying theories and principles of these topics, as well as their practical applications and implications for organizations, are covered.

**Prerequisite(s):** (COOP 3945 (may be taken concurrently) with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 (may be taken concurrently) with a minimum grade of S); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C)

**Attribute(s):** NUpath Writing Intensive

**ORGB 3203. Behavioral Aspects of Digital Transformation. (4 Hours)**

Examines the relationship between digital technologies and human behavior through the lens of foundational organizational behavior frameworks. Covers issues related to the impact of digital technologies on behavior and the impact of human behavior on the development of these technologies and the process of digital transformation. Analyzes the behavioral implications of current developments in digitalization and digital transformation. Topics include algorithmic management, bias in training large language models, AI-driven influence, behavioral responses to disruptive change, and leadership of transformation.

**Prerequisite(s):** (COOP 3945 (may be taken concurrently) with a minimum grade of S or COOP 3946 with a minimum grade of S or COOP 3947 with a minimum grade of S or COOP 3948 with a minimum grade of S); (ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C)

**Attribute(s):** NUpath Writing Intensive

**ORGB 3209. Organizational Behavior. (4 Hours)**

Does not count as credit for business majors. Counts as ORGB 3201 for business minors only.

**ORGB 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ORGB 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**ORGB 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of faculty members of the department on a chosen topic. Course content depends on instructor. May be repeated up to four times for a maximum of 8 semester hours.

**Pharmaceutical Science (PHSC)****PHSC 1001. Introduction to Contemporary Pharmaceutical Sciences. (1 Hour)**

Introduces multiple aspects of the contemporary pharmaceutical sciences. Explores how these disciplines are used to solve real-world medical problems. Offers students an opportunity to learn about foundational concepts in pharmacology; drug development and translational medicine; and the nexus of biotechnology, engineering, industry, entrepreneurship, and the career landscape for scientists. Discussion-based classes that introduce fundamental concepts are followed by student-driven classes that explore the real-world application and societal context of the material. Seeks to help students interested in pharmaceutical sciences to identify and interact with like-minded students and faculty researchers.

**PHSC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHSC 2000. Professional Development for Pharmaceutical Sciences Co-op. (1 Hour)**

Introduces students to the pharmaceutical sciences cooperative education program and professionalism in the field. Students assess their workplace skills, interests, and values and discuss how these impact personal career decisions. Offers students an opportunity to develop effective job search and career management skills, prepare a professional resumé, learn proper interviewing techniques, develop a strong online professional profile, and learn how to use the Northeastern job database and referral process.

**PHSC 2100. Lab Research Rotation. (4 Hours)**

Offers students an opportunity to conduct laboratory research under the direct supervision of a laboratory mentor, generally a faculty member or laboratory director, gain experience in research techniques, and develop good laboratory practices as they learn about research topics under investigation in the laboratory of their choice. Students attend seminars, departmental events, and other activities relevant to the mentor's laboratory. The time commitment is at least eight hours a week. Mentor expectations and grading criteria are decided upon between the student and the mentor prior to the start of the rotation and must be approved by the course director. Students prepare a presentation that encompasses the research performed by the student that includes description, experimental design, data generated, data interpretation, and discussion of their research project. May be repeated once.

**PHSC 2301. Human Physiology 1. (3 Hours)**

Provides students with an understanding of the principles of physiology. Discusses physiological information mostly related to cardiovascular, respiratory, digestive, urinary, and endocrine systems. Focuses on the physiological mechanisms of the major organ systems. Physiological information is related to the specific areas of pharmacology.

**Prerequisite(s):** BIOL 1113 with a minimum grade of C-

**Corequisite(s):** PHSC 2302

**PHSC 2302. Human Anatomy Lab. (1 Hour)**

Accompanies PHSC 2301. Focuses on the anatomy of the major organ systems. Digital images allow each student to study the structure of each organ system in-depth.

**Prerequisite(s):** BIOL 1113 with a minimum grade of C-

**Corequisite(s):** PHSC 2301

**PHSC 2303. Human Physiology 2. (3 Hours)**

Continues PHSC 2301. Provides students with an understanding of the principles of physiology. Discusses physiological information mostly related to cell physiology, muscle physiology, and physiology of the nervous system. Focuses on the physiological mechanisms of the major organ systems. Physiological information is related to the specific areas of pharmacology.

**Prerequisite(s):** PHSC 2301 with a minimum grade of C ; PHSC 2302 with a minimum grade of C

**Corequisite(s):** PHSC 2304

**PHSC 2304. Human Physiology Lab. (1 Hour)**

Accompanies PHSC 2303. Covers topics from the course through various experiments.

**Prerequisite(s):** PHSC 2301 with a minimum grade of C ; PHSC 2302 with a minimum grade of C

**Corequisite(s):** PHSC 2303

**PHSC 2320. Biochemistry. (4 Hours)**

Introduces the structures, functions, and metabolism of amino acids, proteins, carbohydrates, lipids, and nucleic acids. Discusses the mechanisms of enzyme reactions, enzyme kinetics, vitamins, biological oxidation-reduction reactions, and bioenergetics, as well as various inborn errors of metabolism.

**PHSC 2330. Immunology. (3 Hours)**

Provides students with an understanding of the principles, mechanisms, organs, cells, and molecules of the innate and adaptive immunity. Monoclonal antibodies, organ transplant immunity, hypersensitivity, tolerance, tumor immunity, autoimmunity, and immunodeficiencies are discussed in light of potential therapeutic interventions. Weekly journal club-style presentation of related assigned topic is required.

**Prerequisite(s):** ((BIOL 2219 with a minimum grade of C ; PHSC 2320 with a minimum grade of C ) or BIOL 3611 with a minimum grade of C ) or graduate program admission

**PHSC 2400. Research Ethics for Beginning Health Scientists. (4 Hours)**

Explores various dimensions of ethical research. Introduces ethical foundations and controversies that are central to understanding and developing appropriate ethical frameworks for engaging in research. Requires students to work collaboratively to carefully develop essential skills for ethical analysis and evaluation of professional code of conduct concerns.

**Attribute(s):** NUpath Ethical Reasoning

**PHSC 2650. Introduction to Health Science Research. (4 Hours)**

Surveys research methods and topics relevant to health science research with the goal of engaging undergraduate students to commit to research training throughout at least one semester and possibly continuing throughout their undergraduate program. Exposes students to lectures addressing the benefits of a research experience and readings of original literature. Health science faculty from across the university present their lines of research focusing on projects that would be available to students. Seeks to familiarize students with use of the scientific method in addressing unsolved problems and to prepare them to select the most appropriate research laboratory to engage in research.

**Prerequisite(s):** BIOL 1111 (may be taken concurrently) with a minimum grade of D- ; (CHEM 1161 (may be taken concurrently) with a minimum grade of D- or CHEM 1211 (may be taken concurrently) with a minimum grade of D- ); (MATH 1241 (may be taken concurrently) with a minimum grade of D- or MATH 1245 (may be taken concurrently) with a minimum grade of D- )

**PHSC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHSC 2991. Research in Pharmaceutical Science. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated once.

**PHSC 3411. Pharmaceutics 1. (4 Hours)**

Develops an understanding of pharmaceutical dosage forms, with emphasis on solids, liquids, semisolids, parenterals, inhalation, and novel drug delivery systems. Combines the discussion of pharmaceutical products developed in industry and those compounded in local pharmacies. Focuses on application of mathematical principles and problem-solving skills in pharmaceutical compounding.

**Prerequisite(s):** (MATH 1241 with a minimum grade of C- or MATH 1245 with a minimum grade of C- or MATH 1341 with a minimum grade of C- ); CHEM 2313 with a minimum grade of C ; (PHYS 1145 with a minimum grade of C or PHYS 1149 with a minimum grade of C or PHYS 1161 with a minimum grade of C ) or graduate program admission

**PHSC 3412. Pharmaceutics 2. (4 Hours)**

Continues PHSC 3411. Examines the physical and chemical properties of the drug as it relates to pharmaceutical product development. Covers concepts of thermodynamics, colligative properties, ionic equilibria and buffers, solubility, complexation and protein binding, reaction kinetics, mass transport, interfacial phenomena and dispersion, and rheology.

**Prerequisite(s):** PHSC 3411 with a minimum grade of C

**PHSC 3419. Pharmaceutics Laboratory. (1 Hour)**

Formulates pharmaceutical dosage forms such as powders, capsules, solutions, suspensions, emulsions, ointments, gels, creams, lotions, and suppositories, and tests the quality of the products in the lab using approved methods of analysis. Also provides an understanding of the physical and chemical properties of drugs as they relate to formulation development through experimental observation of dissolution, stability, and effects of pH and co-solvent on solubility of drugs.

**Prerequisite(s):** PHSC 3411 (may be taken concurrently) with a minimum grade of C

**PHSC 3430. Pharmacokinetics and Biopharmaceutics. (3 Hours)**

Focuses on the basic principles and methods of biopharmaceutics and pharmacokinetics. Covers the kinetics of drug absorption, distribution, metabolism, and excretion; linear and nonlinear pharmacokinetics; general concept of one- and two-compartment models with instantaneous (i.v. bolus), zero order (i.v. infusion), or first order (oral administration or i.m. injection) input; evaluation of bioavailability and investigation of the factors affecting drug availability; influence of the route of administration, dosage form, and regimen on bioavailability of drugs; bioequivalence study; multiple dosing kinetics; general approaches to dosage adjustment in renal disease; noncompartmental analysis; and pharmacokinetic-pharmacodynamic modeling.

**Attribute(s):** NUpath Analyzing/Using Data

**PHSC 3510. Medicinal Cannabis and Translational Cannabinoid Research. (4 Hours)**

Introduces fundamentals of medical cannabis and cannabinoid research. Includes foundational concepts of medicinal and psychoactive ingredients of marijuana, the human endocannabinoid system (ECS), cannabinoid receptors, and endocannabinoids. Reviews the growing nationwide acceptance of cannabis; the federal and state laws/policies regulating cannabis supply chain; research and product development along with effectiveness, safety, and side effects of cannabis for various ailments; and advances in the discovery/development of ECS-targeting drugs. Promotes the preparedness for conducting research, providing patient consultation, and working with healthcare providers and policymakers in this field. Alumni and external guests are invited to share clinical and industrial insights.

**Prerequisite(s):** (CHEM 2311 with a minimum grade of D- or CHEM 1104 with a minimum grade of D- or CHM 2110 with a minimum grade of D-); (BIOL 1111 with a minimum grade of D- or BIOL 1113 with a minimum grade of D- )

**PHSC 3801. Principles of Pharmacology and Medicinal Chemistry 1. (4 Hours)**

Introduces the principles and basic concepts of pharmacology and medicinal chemistry and the general mechanisms of drug action, including drug receptor interactions. Discusses the major functional groups and their contributions to receptor interactions, metabolism, and toxicity. Covers drug classes affecting the peripheral autonomic and central nervous systems. Considers therapeutic uses, mechanisms of drug action, and undesirable actions, including side effects and adverse reactions.

**Prerequisite(s):** BIOL 2219 with a minimum grade of D ; CHEM 2313 with a minimum grade of D

**PHSC 3802. Principles of Pharmacology and Medicinal Chemistry 2. (4 Hours)**

Continues PHSC 3801 and covers the principles and basic concepts of pharmacology and medicinal chemistry and the general mechanisms of drug action, including drug receptor interactions. Discusses the major functional groups and their contributions to receptor interactions, metabolism, and toxicity. Considers therapeutic uses, mechanisms of drug action, and undesirable actions, including side effects and adverse reactions.

**Prerequisite(s):** PHSC 3801 with a minimum grade of D

**PHSC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHSC 4501. Pharmacology/Medicinal Chemistry 1. (5 Hours)**

Introduces the principles and basic concepts of pharmacology and the general mechanisms of drug action including drug receptor interactions. Discusses the major drug classes affecting the peripheral autonomic and central nervous systems including anxiolytics, sedative-hypnotics, anesthetics, anticonvulsants, neuroleptics, antidepressants, and antimanic agents. Considers therapeutic uses, mechanisms of drug action, and undesirable actions including side effects and adverse reactions.

**Prerequisite(s):** ((PHSC 2303 with a minimum grade of C or BIOL 2219 with a minimum grade of C ); CHEM 2313 with a minimum grade of C ) or graduate program admission

**PHSC 4502. Pharmacology/Medicinal Chemistry 2. (5 Hours)**

Continues PHSC 4501. Covers the mechanisms of action, structure-activity relationships, therapeutic uses, and adverse effects of drugs including cardiovascular agents, hormones, anticancer drugs, antibiotics, and antiinflammatory agents.

**Prerequisite(s):** PHSC 4501 with a minimum grade of C

**PHSC 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**PHSC 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** PHSC 4970 with a minimum grade of C

**PHSC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHSC 4995. Practicum. (1-4 Hours)**

Offers eligible students an opportunity for practical experience. May be repeated without limit.

**PHSC 4997. Senior Thesis. (4 Hours)**

Offers students an opportunity to prepare an undergraduate thesis under faculty supervision.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PHSC 4998. Senior Thesis Continuation. (4 Hours)**

Offers students an opportunity to execute a project as described in PHSC 4997, which involves laboratory work; skill development; and the ability to generate, analyze, and report valid and reproducible data with the highest level of honesty and integrity. Students write and defend a thesis project to a public audience that describes the scientific background and context of the research, the hypothesis tested, methods utilized, and experimental results obtained. The thesis also includes interpretation of data, its contribution to the field, and future directions for the research. Students are expected to demonstrate motivation and initiative and to develop skills necessary to work cooperatively with a faculty mentor and other lab personnel.

**Prerequisite(s):** PHSC 4997 with a minimum grade of D-

**Attribute(s):** NUpath Writing Intensive

**PHSC 5100. Concepts in Pharmaceutical Science. (2 Hours)**

Introduces new students in the Pharmaceutical Science Graduate Program to important concepts in medicinal and combinatorial chemistry as they relate to drug discovery, and a brief overview of pharmacology, drug metabolism, pharmacokinetics, and toxicology. Also introduces the major drug receptor families and their signaling pathways.

**PHSC 5102. Concepts in Pharmaceutical Science 2. (2 Hours)**

Presents key concepts and challenges of drug design, development, and evaluation. Integrates the principles of drug design, development, and delivery in a discussion of both small-molecule formulations and biologics. Contextualizes the hallmarks along the path of preclinical drug design to clinical translation. Components of the course include Team-Based Learning (TBL) and professionalism. The TBL sessions offer students an opportunity to work on course-related team applications and include graded peer evaluations.

**PHSC 5110. Integrated Science and Therapeutics 1. (4 Hours)**

Integrates foundational concepts of pharmacology, medicinal chemistry, pathophysiology, and pharmacotherapeutics to treat patients with hypertension, diabetes, and hyperlipidemia. Studies knowledge, skills, and attitudes pertaining to drug action, drug-receptor interactions, structure-activity relationships, dose-response relationships, drug mechanisms of action, therapeutic uses, and adverse effects. Offers students an opportunity to develop patient evaluation skills using the Pharmacists' Patient Care Process and identification of drug therapy problems. Emphasizes self-care, patient education, assessment, medication administration, management and monitoring, and preventative health and population-based health outcomes.#.

**Prerequisite(s):** (PHSC 2303 with a minimum grade of D- ; PHSC 2304 with a minimum grade of D- ; ENGW 3306 with a minimum grade of D- ) or graduate program admission

**PHSC 5130. Foundations of Pharmaceutical Sciences 1. (4 Hours)**

Examines physical and chemical properties of drugs and discusses pharmaceutical products developed in industry and compounded in pharmacies. Focuses on application of mathematical principles and problem-solving skills in pharmaceutical compounding of dosage forms including solids, liquids, parenterals, inhalation, and novel drug delivery systems. Discusses thermodynamics, colligative properties, ionic equilibria and buffers, solubility, protein binding, and reaction kinetics.##.

**Prerequisite(s):** ((MATH 1241 with a minimum grade of D- or MATH 1245 with a minimum grade of D- or MATH 1341 with a minimum grade of D- ); CHEM 2313 with a minimum grade of D- ) or graduate program admission

**PHSC 5181. Integrated Learning Lab 1. (1 Hour)**

Offers students an opportunity to develop and assimilate knowledge, skills, and attitudes related to the pharmaceutical care of patients to supplement and augment pharmacy curricular topics within an immersive learning experience. Includes pharmaceutics, healthcare systems, professional communication skills, research methods, drug information, jurisprudence, patient counseling, and aseptic technique/compounding. Uses innovative digital tools, environments, equipment, learning materials, and pedagogical methods that promote the development and refinement of problem-solving skills, adaptability/resilience, and a team mindset that can be applied during experiential activities (co-op/introductory pharmacy practice experience/ advanced pharmacy practice experience), as well as future careers.

**PHSC 5205. Integrated Science and Therapeutics 3. (4 Hours)**

Integrates foundational concepts of pharmacology, medicinal chemistry, pathophysiology, immunology, and pharmacotherapeutics to treat patients with acute and chronic rheumatologic, immune-mediated, dermatologic, and oncologic diseases. Offers students an opportunity to develop knowledge, skills, and attitudes pertaining to drug action, drug-receptor interactions, structure-activity relationships, dose-response relationships, drug mechanisms of action, therapeutic uses, and adverse effects. Focuses on developing patient evaluation skills using the Pharmacists' Patient Care Process and identification of drug therapy problems. Emphasizes self-care, patient education, assessment, medication administration, management, and monitoring, as well as preventative health and population-based health outcomes.

**Prerequisite(s):** (PHMD 5115 with a minimum grade of D- ; PHMD 5182 with a minimum grade of D- ; PHMD 5192 with a minimum grade of D- ) or graduate program admission

**PHSC 5212. Research Skills and Ethics. (2 Hours)**

Covers the basics of laboratory safety, safekeeping laboratory data, and the process of writing a grant proposal. Explores the concepts of data distortion or fabrication, conflicts of interest, confidentiality, ethical aspects of peer review, and the attribution of credit in science.

**PHSC 5230. Foundations of Pharmaceutical Sciences 2. (4 Hours)**

Introduces fundamental concepts and applications of biopharmaceutics and pharmacokinetics. Offers students an opportunity to integrate knowledge, skills, and concepts to clinically treat patients. Discusses pharmacokinetic analysis and modeling; one-compartment, two-compartment, and three-compartment models; multiple dosing kinetics; methods of calculation; dosage adjustment in renal impairment; and noncompartmental analysis.

**Prerequisite(s):** (PHSC 5130 with a minimum grade of D- ; PHSC 5181 with a minimum grade of D- ) or graduate program admission

**PHSC 5290. Foundational Biochemistry for Pharmaceutical Engineering. (2 Hours)**

Introduces the fundamental principles of biochemistry, emphasizing the chemical and molecular basis of life. Covers the structure, function, and interactions of biological macromolecules such as proteins, nucleic acids, lipids, and carbohydrates. Studies key biochemical processes, including enzyme catalysis, metabolism, and energy transfer, as well as the role of biochemical principles in cellular functions. Provides the opportunity to integrate basic chemistry concepts such as thermodynamics, acid-base equilibrium, and molecular bonding to establish a solid foundation for understanding complex biological systems.

**PHSC 5300. Pharmaceutical Biochemistry. (2 Hours)**

Offers students an opportunity to obtain an understanding of the principles of physiological chemistry. Focuses in-depth on the major topics of physiological chemistry, including general chemistry and biomolecules, peptide synthesis and protein structure, carbohydrates and nucleic acids, thermodynamics and kinetics of molecular interactions, and colloids and micelles. Relates biochemical information to the specific areas of pharmacology, pharmaceutics, and drug discovery/development.

**PHSC 5305. Professional Development for Pharmaceutical Sciences. (1 Hour)**

Introduces and examines the goals, expectations, policies, and procedures of the Masters' in Pharmaceutical Sciences internship program and professionalism in the field. Discusses the role and involvement of internship employers. Offers students an opportunity to develop job search and career management skills; assess their workplace skills, interests, and values; discuss how those qualities impact career decisions; prepare a professional resumé; and learn proper interviewing techniques. Issues of ethics and professionalism are designed to inform students of issues they will face in the pharmaceutical field. Content of this course is geared to students' participation in the internship program and overall professional development in pharmaceutical sciences.

**PHSC 5310. Cellular Physiology. (2 Hours)**

Focuses in-depth on the major cellular physiological mechanisms, including physiology of the cell membrane, ion channels and transport phenomena, energy production, signal transduction, synapses, and physiological processes in the cytosol. Relates physiological information on the specific areas of pharmacology, pharmaceutics, and drug discovery/development. Offers students an opportunity to obtain an understanding of the principles of cellular physiology.

**PHSC 5360. Anti-Infectives. (4 Hours)**

Reviews the structure and physiology of bacteria, fungi, and viruses and surveys significant organisms of medical importance. Introduces specific antibiotic, antifungal, and antiviral agents and classes of agents once a foundation of knowledge of the microorganisms that cause disease is established. Discusses concepts of pharmacology, pharmacokinetics, antimicrobial resistance, pharmacodynamics of antimicrobial agents, and spectra of activity.

**Prerequisite(s):** PHSC 4502 with a minimum grade of D-

**PHSC 5400. Principles of Drug Design. (3 Hours)**

Studies important aspects of drug discovery and development with a focus on drug design. Covers basic organic medicinal chemistry concepts and seeks to build students' skills in lead compound discovery, structure-activity relationship studies, and lead optimization strategies. Topics include the fundamentals of pharmacology, pharmacokinetics, and pharmacodynamics of therapeutic agents relevant to the drug-structure optimization. These skills often help develop a strong foundation in the concepts that govern the multidisciplinary process of drug discovery. Uses lectures and peer-reviewed seminar presentations to help students to incrementally increase their knowledge required to identify new, marketable therapeutic agents. Requires organic or medicinal chemistry at the undergraduate level.

**PHSC 5450. Contemporary Approaches to Drug Design. (3 Hours)**

Introduces current and emerging trends and concepts in drug discovery in the context of targeted disease therapy and structure-based drug design. Reviews and discusses topics on target selection and validation, computational drug design tools, kinase inhibitors, proteolysis targeting chimeras and molecular glues, covalent drugs, cannabinoid receptors, RNA-targeting small molecule agents, and protein-protein interaction modulators. Exemplifies the applications of general medicinal chemistry and pharmacology principles to real-world drug discovery and development.

**PHSC 5500. Repurposing Drugs for Cancer Immunotherapies. (2 Hours)**

Offers a multidisciplinary course targeted to students interested in recent advances in biomedical research, clinical practice, and personalized medicine as related to cancer immunotherapies. Describes current promises and disappointments with cancer immunotherapies and recent FDA drug approvals for personalized cancer therapies. Explains the role of immunological and physiological negative regulators of antitumor and tumor biology as needed. Explains underlying principles of immunology, biochemistry, genetics, and preclinical and clinical studies when introducing new concepts. Assigned detailed study of specific areas and discussion of assigned papers are designed to complement classroom material.

**PHSC 5555. Pharmaceutical Toxicology. (3 Hours)**

Covers fundamental concepts of toxicology and technical methods in toxicology along with comprehensive analysis of both in-vitro and in-vivo toxicity in drug discovery and development. Through lectures given by experts in various fields in toxicology on several topics required for specialized work in research, industrial, and clinical settings, offers students an opportunity to become familiar with methods and analyses including in-vitro and in-vivo toxicity assessments and toxicokinetic-toxicodynamic models and analyses. Includes mechanistic basis of toxicity, methods of toxicological analysis, and case studies pertinent to topics. Requires undergraduate physiology or biochemistry.

**PHSC 5560. Nanotoxicity. (3 Hours)**

Studies nanotoxicity, the adverse health effects of nanoparticles. Due to their small size, nanoparticles easily cross biological barriers, entering body fluids and cells. Nanoparticles toxicity may cause chronic and acute pathologies. Offers students an opportunity to develop and understand the principles of nanotoxicity. Focuses on mechanisms of cellular and organ damage by nanoparticles. Discusses ports of nanoparticle entry and detrimental effects upon blood, CNS, lungs, and GI system. Stresses mechanisms of intracellular degradation of nanoparticles and toxic effects of nanoparticles upon human cells and major organ systems. Reviews mechanisms of cellular and organ damage including oxidative stress, inflammation, and DNA, as well as toxic effects on nonmammalian cells.

**PHSC 5900. AI in Drug Discovery and Development. (4 Hours)**

Explores key ideas in artificial intelligence (AI) while delving into trending developments in drug discovery and development. Develops the knowledge, skills and attitudes necessary to confidently navigate the ever-evolving landscape of artificial intelligence. Examines AI tools and frameworks to enable effective collaboration across stakeholders in the pharmaceutical industry space. Technical background in AI/computer science not required.

**PHSC 5905. Artificial Intelligence and Machine Learning in Drug Discovery: Concepts and Applications. (4 Hours)**

Provides hands-on opportunities to explore the intersection of artificial intelligence (AI) and drug discovery. Presents real-world drug discovery challenges supported by faculty mentorship, applying artificial intelligence and machine learning (ML) techniques to a drug discovery program. Includes industry experts discussing the latest advancements in the pharmaceutical sector, and their use of AI/ML tools to drive innovation. Investigates key AI tools and frameworks that facilitate rapid progress in the pharmaceutical sector. Develops practical skills in data analysis, model building, and algorithm selection to drive innovation in drug discovery.

**Prerequisite(s):** (CHEM 2311 with a minimum grade of D- or CHEM 2311 with a minimum grade of D- or CHEM 2311 with a minimum grade of D-) or graduate program admission

**PHSC 5910. Applied Sciences for the Cannabis Industry. (4 Hours)**

Explores fundamentals of cannabis and cannabinoid analysis, i.e., to choose and interpret a method of analysis based upon the molecule (e.g., CBD and THC), sample origin (human, plant, etc.), and application. Discusses medicinal cannabinoids, psychoactive cannabinoids, and endocannabinoids, as well as cannabinoid biology, on-target and off-target effects, toxicity and pharmacokinetics. Reviews the legal and regulatory framework concerning key cannabinoids. Integrates the topics above into three areas: “targeted” analytical methods for quantification of key cannabinoids in plant, product, and human preparations; “discovery” analytical methods for profiling multiple cannabinoids and their metabolites; and application of analytical methods to law enforcement, product potency testing and quality control, toxicology, and clinical trial monitoring.

**Prerequisite(s):** ((BIOC 1000 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- or BIOT 5120 with a minimum grade of D- or BIOT 5120 with a minimum grade of D- or BIOT 5120 with a minimum grade of C- (Graduate) or PHSC 2320 with a minimum grade of D- ); (CHEM 2311 with a minimum grade of D- or CHEM 2311 with a minimum grade of D- or CHEM 2311 with a minimum grade of D- or CHEM 2315 with a minimum grade of D- )) or graduate program admission

**PHSC 5920. Clinical Application of Cannabis and Cannabinoids. (4 Hours)**

Focuses on the application of (pre)clinical research results from experimental and human cannabis and cannabinoid research to therapeutics invention. Develops foundational knowledge of the drug-approval process and its oversight/regulatory processes, drug-target identification/validation, the human endocannabinoid system, ECS drug targets for drug-like small molecules, and addresses unsolved medical problems by advancing ECS modulators as potential drug treatments for various diseases. Reviews relevant literature on these topics relating to the medical applications of cannabis and new chemical entities that modulate the ECS. Discusses the design and outcomes of natural and synthetic ECS-targeting agents for indications including overweight/obesity, pain management, and substance-use disorders. Promotes the preparedness for conducting research, consultation and working with healthcare providers and policy makers. External guests are invited to share clinical/industrial insights.

**Prerequisite(s):** ((BIOL 1111 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- ); (CHEM 2311 with a minimum grade of D- or CHEM 2311 with a minimum grade of D- or CHEM 2311 with a minimum grade of D- or PHSC 3801 with a minimum grade of D- )) or graduate program admission

**PHSC 5930. Advanced Translational Research on Medical Cannabis and Cannabinoids. (4 Hours)**

Reviews medicinal and psychoactive constituents of cannabis, the components of human endocannabinoid system (ECS, e.g., endocannabinoids and cannabinoid receptors) and the therapeutic intervention of ECS. Discusses historical and ongoing debates on marijuana as well as the growing nationwide acceptance of marijuana for medical and recreational applications. Introduces federal and state laws/policies regulating cannabis/marijuana, and the effectiveness, safety and side effects of cannabis products for various indications. Reviews the latest methodology and advances in the discovery of ECS-targeting new chemical entities. Promotes preparedness for conducting research, providing consultation and working with healthcare providers and policy makers in the field of cannabis and cannabinoids. External experts are invited to share clinical and industrial insights.

**Prerequisite(s):** ((BIOL 1111 with a minimum grade of D- or BIOL 1111 with a minimum grade of D- ); (CHEM 2311 with a minimum grade of D- or CHEM 2311 with a minimum grade of D- or CHEM 2311 with a minimum grade of D- )) or graduate program admission

**PHSC 5940. Cannabis Laws, Standards, and Politics. (4 Hours)**

Examines the evolution of cannabis laws, standards, and politics from ancient times to the present through an interdisciplinary lens. Explores historical state and federal conflicts surrounding medical and adult-use cannabis and analyzes their public health impacts. Discusses current cannabis research, various cannabis strains, cannabinoids, and cannabis-based pharmaceuticals and builds a strong foundation in the legal, regulatory, and operational aspects of cannabis and hemp businesses, focusing on three key considerations: state and local laws, scientific information, and science-based policy. Discusses the public health consequences of unregulated products while identifying distinctions between legal and illegal cannabis products and their abuse potential.

**PHSC 5976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**Prerequisite(s):** PHSC 5100 with a minimum grade of C or PHSC 5100 with a minimum grade of C

**PHSC 5984. Research. (1-4 Hours)**

Offers students an opportunity to conduct research under faculty supervision. May be repeated up to nine times.

**PHSC 6213. Ethical Problems in Health Sciences Research. (2 Hours)**

Focuses on a series of cases that raise ethical and professional code of conduct concerns and engages with them collaboratively and carefully to develop essential skills for ethical analysis and evaluation. Scientific practice presents researchers and citizens with myriad ethical challenges. Engaging with those ethical challenges in ways that help yield the benefits of research while respecting ethical boundaries is furthered by not only understanding ethical frameworks but by carefully analyzing and evaluating ethical concerns in context.

**Prerequisite(s):** PHSC 6212 (may be taken concurrently) with a minimum grade of C- or PHSC 5212 with a minimum grade of C- or PHSC 2400 with a minimum grade of C-

**PHSC 6214. Experimental Design and Biostatistics. (2 Hours)**

Discusses fundamental principles of experimental design and statistical analysis, with emphasis on clinical research. Topics include descriptive statistics, hypothesis testing, analysis of variance, correlation, regression, chi-square test, and nonparametric methods.

**PHSC 6216. Human Physiology and Pathophysiology. (2 Hours)**

Introduces major topics in human physiology, emphasizing knowledge essential to health-related laboratory research. Topics include neurophysiology, immunology, cardiovascular, respiratory, renal, and gastrointestinal physiology and endocrinology.

**PHSC 6222. The Chemistry and Biology of Drugs of Abuse. (2 Hours)**

Provides an interdisciplinary introduction to substance abuse, including the medicinal chemistry and neurobiology of drugs that act through the opioid, dopamine, acetylcholine, and cannabinoid systems. Compares and contrasts neurochemical mechanisms that are common to many addictive agents and those that are specific to individual drug classes. Highlights the involvement of the brain dopamine system and differences and discusses similarities between the pharmacology of abused and therapeutic drugs, together with the development of medications for treating drug dependence. Includes lectures by experts on particular topics of their own recent research. Introduces students to key aspects of biological and chemical research as they pertain to drug abuse and its treatment.

**PHSC 6224. Behavioral Pharmacology and Drug Discovery. (2 Hours)**

Designed to prepare students to understand the advantages, shortcomings, and pitfalls of the use of live, behaving animals in drug discovery. Covers an in-depth analysis of ethical issues in animal research, as well as aspects of animal behavioral models, behavior and brain biochemistry, and methods of behavioral analysis. Specific topics include psychopharmacology; fear and anxiety; pain and stress; depression and reward; general arousal and tolerance; drug abuse and habitual behaviors. The ways in which animal behaviors can be described in a quantitative manner and the effects of medications and abused drugs quantified and related to human diseases and drug responses are an important component of the course.

**PHSC 6235. Magnetic Resonance Imaging in Drug Discovery 1. (4 Hours)**

Integrates physics, mathematics, and neuroscience with the cutting-edge technology of magnetic resonance imaging (MRI) to address drug discovery in the treatment of CNS disorders. Students design their own experiments guided by knowledge of the literature and technical and statistical limitations. Offers students an opportunity to run a state-of-the-art 7.0 Tesla MR animal scanner housed in the Center for Translational NeurolImaging (CTNI) at Northeastern and set parameters for anatomical and functional imaging protocols. Original imaging data is collected and analyzed. This is a discovery-based research course that encourages critical thinking and transdisciplinary learning skills involving an original research project in magnetic resonance imaging related to early drug discovery.

**Prerequisite(s):** PHSC 5100 with a minimum grade of C or PHSC 5100 with a minimum grade of C

**PHSC 6237. Magnetic Resonance Imaging in Drug Discovery 2. (2 Hours)**

Continues PHSC 6235. Offers students an opportunity to continue their research work in early drug discovery using original imaging data that was previously analyzed. Focuses on manuscript preparation and submission to a peer-reviewed journal.

**Prerequisite(s):** PHSC 6235 with a minimum grade of C

**PHSC 6290. Biophysical Methods in Drug Discovery. (2 Hours)**

Provides an interdisciplinary introduction to biophysical methods used in modern drug discovery, including hit generation and lead optimization. Emphasizes key experimental methods, including nuclear magnetic resonance (NMR) spectroscopy and X-ray crystallography, as well as computer modeling as applied to ligand- and structure-based drug design. Includes lectures by experts on related topics from their recent drug-discovery research. Presented under the auspices of the Center for Drug Discovery. Requires permission of instructor for students of junior or senior standing.

**PHSC 6300. Pharmaceutical Science Seminar. (1 Hour)**

Teaches students to evaluate critically the scientific literature in a journal club format. Several sections may be offered each semester to accommodate different specializations or interest groups. May be repeated without limit.

**PHSC 6401. Pharmaceutical Science Internship. (1 Hour)**

Offers an experiential component of the graduate curriculum that fosters professional development through internship in drug discovery, development, and/or regulatory affairs in a pharmaceutical or biotechnology company. Requires students to work in a company for a minimum of twenty hours per week. Offers students an opportunity to engage in pharmaceutical science research or to work in an environment outside the University but under the supervision of a faculty instructor. May be repeated up to three times.

**Prerequisite(s):** PHSC 5305 with a minimum grade of C-

**PHSC 6760. Doctoral Pharmaceutical Science Research 1. (2 Hours)**

Offers PhD research in preparation for thesis proposal.

**PHSC 6810. Pharmaceutical Science Colloquium. (1 Hour)**

Requires students to present one formal seminar on their research. This presentation is open to all those interested.

**Prerequisite(s):** PHSC 9681 with a minimum grade of S

**PHSC 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHSC 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**PHSC 6984. Pharmaceutical Science Research. (2 Hours)**

Offers students laboratory research under the guidance of an adviser. May be repeated once for up to 4 total credits.

**PHSC 6990. Thesis. (2 Hours)**

Offers research/experimental work for master's thesis. Students may register twice. May be repeated once.

**PHSC 6996. Thesis Continuation. (0 Hours)**

Offers continued registration while student completes master's thesis or other research project to meet the research requirement in pharmaceutical science.

**PHSC 7010. Pharmaceutical Sciences Laboratory. (4 Hours)**

Offers a hands-on graduate laboratory course that introduces students to the investigative approaches and laboratory methods used in contemporary pharmaceutical sciences research. Laboratory exercises have a practical relationship to essential techniques in modern drug discovery, drug targeting and delivery, and determining mechanisms of drug action. These exercises cover basic laboratory skills, the rationale for and application of standard laboratory methods, training in the use of equipment and techniques central to pharmaceutical sciences research, how to maintain a laboratory notebook, statistical analysis and interpretation of data, and how to present research results in technical laboratory reports.

**PHSC 7020. Scientific Writing: Thesis Proposal. (2 Hours)**

Presents the principles of writing a proposal based on the NIH R01 grant proposal template used by the department. Participants develop their own proposal in collaboration with their faculty advisor or the immediate project supervisor designated by their faculty advisor (the project principle investigator). Offers students an opportunity to meet with their own project principle investigators to develop content and map out the project aims and experimental design and to produce a revised draft of their thesis proposal. Each student must have initiated MS or PhD thesis research and have some preliminary data; PhD students must have passed their qualifying exam; MS students must petition the graduate committee in writing for permission to enroll.

**PHSC 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**PHSC 8940. Doctoral Training and Research. (1 Hour)**

Intended to show full-time status for pharmaceutical science PhD students in the semester in which they are taking the comprehensive exam. In addition to successfully completing the comprehensive exam, students are expected to perform research in preparation for the doctoral proposal; the grade for this course documents successful performance.

**PHSC 8984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated up to four times.

**PHSC 8986. Doctoral Full-Time Research. (0 Hours)**

Expect student to conduct full-time research in an adviser's laboratory. May be repeated without limit.

**PHSC 9000. Comprehensive Exam. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**PHSC 9681. Doctoral Proposal. (2 Hours)**

Offers preparation of PhD dissertation proposal and proposal defense before dissertation committee. Requires passing of comprehensive exam. May be repeated without limit.

**Prerequisite(s):** PHSC 8940 with a minimum grade of S

**PHSC 9990. Dissertation Term 1. (0 Hours)**

Offers research/experimental work for PhD thesis.

**Prerequisite(s):** PHSC 9681 with a minimum grade of C ; PHSC 9000 with a minimum grade of S

**PHSC 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** PHSC 9990 with a minimum grade of S

**PHSC 9996. Dissertation Continuation. (0 Hours)**

Offers continuation of PhD dissertation research.

**Prerequisite(s):** PHSC 9991 with a minimum grade of S or Dissertation Check with a score of REQ

**Pharmaceutics (PMST)****PMST 6250. Advanced Physical Pharmacy. (2 Hours)**

Covers the physical and chemical principles in drug formulation design, with emphasis on such topics as solutions of nonelectrolytes and electrolytes, ionic equilibria, drug complexation, reaction kinetics, mass transport, and interfacial phenomena.

**PMST 6252. Pharmacokinetics and Drug Metabolism. (3 Hours)**

Focuses on concepts of one- and two-compartment linear and nonlinear pharmacokinetics and compartmental modeling with plasma and/or urinary data. Discusses principles and methods of metabolic biotransformation and disposition of xenobiotics in biological system.

**PMST 6254. Advanced Drug Delivery Systems. (3 Hours)**

Examines in-depth the role of sustained, controlled, and site-specific delivery systems for drugs and genetic materials using polymeric systems, colloidal drug delivery systems, and vectors for gene therapy.

**PMST 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Pharmacology (PMCL)****PMCL 6250. Ion Channel Physiology and Pharmacology. (3 Hours)**

Focuses on ion channel proteins, their structure and function, as well as pharmacology. Drug action is pursued based on mechanisms used to control the gating/trafficking of ion channels that modulate their activity and cell surface localization. Introduces students to molecular modeling and dynamic simulations that can capture the gating process and ion permeation of ion channels and provide a mechanistic guide of structure-based drug design. Reviews ion channels and the drugs that target them that apply to a wide variety of medical conditions, such as arrhythmias, hypertension, epilepsy, pain, local anesthesia, cystic fibrosis, and depression. Offers students an opportunity to perform simulations on ion channels with known drugs to establish models for future lead design and development studies.

**PMCL 6252. Small-Molecule Target and Ligand Pharmacology. (4 Hours)**

Focuses on ligand-gated ion channel proteins, G-protein coupled receptors and enzymes, their structure and function, as well as pharmacology. Drug action is pursued based on mechanisms used to control cell signaling and gene expression. Offers students an opportunity to apply physiologic systems and drugs used to treat related pathologies, as well as in silico modeling, to study these effects.

**PMCL 6261. Pharmacology 2. (2 Hours)**

Continues PMCL 6260, although in a format that is not contingent that PMCL 6260 precedes this course.

**Prerequisite(s):** (PHSC 5100 with a minimum grade of C or PHSC 5100 with a minimum grade of C)

**PMCL 6262. Receptor Pharmacology. (2 Hours)**

Reviews receptors for drug substances and for endogenous ligands in a format that combines lecture presentations and discussion. Focuses on the evaluation of current literature. Covers techniques available to study receptors, various models for receptor-ligand interactions, stereochemical aspects of receptor interactions, receptor-mediated coupling mechanisms, and evaluation of several specific receptor systems.

**Prerequisite(s):** PHSC 5100 with a minimum grade of C- or PHSC 5100 with a minimum grade of D-

**PMCL 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Pharmacy Practice (PHMD)

### **PHMD 1000. College: An Introduction. (1 Hour)**

Introduces the University, college, and health professions to enhance students' understanding of self and the decisions they make academically and socially as members of the University's diverse, multicultural community. Offers students an opportunity to engage in group activities and individual assignments along with active participation in a learning community to help them adjust to life on an urban campus, develop a better understanding of the learning process, acquire essential academic skills, and make connections with the faculty and students in the college.

### **PHMD 1001. Introduction to the Profession of Pharmacy. (1 Hour)**

Introduces the profession of pharmacy. Addresses professionalism, pharmacists' responsibilities, and the education and training of pharmacists.

### **PHMD 1100. Exploring Pharmacy As a Career. (2 Hours)**

Introduces the profession of pharmacy through the completion of readings and activities that allows facilitators to guide in-class discussions to provide a broad overview of the pharmacist's responsibilities. Explores the education and training of a pharmacist, the roles and responsibilities of learners within a professional degree program, and the requirements to become a pharmacy certified technician. Addresses possible pharmacist career pathways, and assists all learners becoming healthcare professionals (premed, pre-PA, nursing, etc.) with their interactions with the profession.

### **PHMD 1201. Introduction to Pharmacy Practice. (2.5 Hours)**

Seeks to prepare pharmacy students for their first introductory pharmacy practice experience (IPPE)/co-op. Introduces students to the policies, procedures, and expectations of the Cooperative Education Program. Offers students an opportunity to develop the skills needed to be successful in the preparation, activity, and reflection components of the pharmacy co-op program; to prepare their first résumés; and to learn proper interviewing techniques. Exposes students to the various co-op opportunities available to them as well as potential career paths within the pharmacy profession. Covers workplace issues including diversity, sexual harassment, ethics, and confidence of information. Introduces students to the technical knowledge and skills required for their first pharmacy experiences in both community and institutional pharmacy practice and to drug information resources. Offers students an opportunity to develop basic communication skills to aid them in successful completion of their first IPPE.

**Corequisite(s):** PHMD 1202

### **PHMD 1202. Lab for PHMD 1201. (0.5 Hours)**

Offers students an opportunity to learn several skills needed for future patient-care experiences. Supplements lecture content and provides practical reinforcement of concepts. Students apply knowledge learned in the classroom related to the appropriate and effective use of communication strategies and basic sterile techniques/manipulations. Labs related to the learning of communication skills support a patient-centered approach in assessing, adapting, and evaluating patient medication use needs.

**Corequisite(s):** PHMD 1201

### **PHMD 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### **PHMD 2310. Professional Communication in Pharmacy Practice. (2 Hours)**

Offers pharmacy students an opportunity to learn the principles for understanding, applying, evaluating, and creating successful verbal and nonverbal communication interactions in a variety of pharmacist and interprofessional settings. Through a patient-centered approach, reviews and builds on core communication skills learned in the foundational introduction to pharmacy practice courses. Topics include using effective communication approaches to detect and intervene to improve adherence, facilitate behavioral change, collaborate with other professionals, and tailor communication to special and culturally diverse patient populations.

**Corequisite(s):** PHMD 2311

**Attribute(s):** NUpath Difference/Diversity

**PHMD 2311. Lab for PHMD 2310. (0.5 Hours)**

Supplements lecture content from PHMD 2310. Designed to provide pharmacy students with several skills needed for future patient-care experiences and provide practical reinforcement of concepts. Students apply knowledge learned in the classroom related to the appropriate and effective use of communication strategies. Labs related to the learning of communication skills support a client-centered approach in assessing, adapting, and evaluating patient medication use needs. Specifically offers students an opportunity to learn and practice six core communication skills: listening, asking questions, providing empathy, understanding and managing confusion, understanding and managing conflict, and understanding and analyzing nonverbal behavior.

**Corequisite(s):** PHMD 2310

**PHMD 2350. Healthcare Systems. (3 Hours)**

Examines the evolution of the American healthcare delivery system from the early forms of organized institutional healthcare through the dynamic, and increasingly integrated, delivery systems of the present. Explores the interactions of regulatory, economic, political, and social aspects of the healthcare system with particular emphasis on pharmacy practices. Compares current policies and proposals for health reform and pharmacy benefit coverage. Analyzes the impact and consequences of national and international actions in one era on the structure, function, and outcomes of healthcare and professional pharmacy practice in later years. Major emphases include factors affecting American population health, health disparities, and strategies, including pharmacy/pharmacists, to improve the nation's health.

**PHMD 2900. Global Self-Care Approaches and Strategies. (4 Hours)**

Develops a basic understanding of self-care and preventive health strategies that consumers use in United States and other cultures/countries. Examines the similarities and differences of the role of over-the-counter (OTC) medications and pharmacy in the healthcare environment through the use of the internet and contemporary media, observations in other countries, and discussions with guest speakers. Explores the clinical use, safety and efficacy of common OTC medications and complementary alternatives (vitamins, minerals, supplements, herbs, homeopathic remedies, etc.) available in the US compared to what is available in other countries. Explores historical and modern community pharmacy environments and other culturally relevant venues in other cultures.

**Attribute(s):** NUpath Integration Experience

**PHMD 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHMD 2991. Research in Pharmacy Practice. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated once.

**PHMD 3450. Research Methodology and Biostatistics. (3 Hours)**

Offers an interactive course covering aspects of research designs used in experimental and observational studies, hypothesis testing, and an introduction to basic biostatistics. Offers students an opportunity to critically examine selected articles from the clinical literature, to analyze the framing of the research question and the methods used to insure the validity and generalizability of the study's findings, and to assess for potential ethical issues in research design and conduct. Clinical trials, observational studies, and problem sets illustrate principles of research design, conduct, and data analysis.

**Prerequisite(s):** (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C ) or graduate program admission

**Attribute(s):** NUpath Ethical Reasoning, NUpath Natural/Designed World

**PHMD 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHMD 4350. Exploring Academic Careers. (2 Hours)**

Designed to prepare students to become more confident and effective as educators for many audiences, including peers, colleagues, clients, and patients. Offers students an opportunity to increase their awareness of teaching and learning principles and related roles and responsibilities as they apply to academic careers and faculty in the classroom, in experiential settings, and in university units. Discusses and explores knowledge, skills, and attitudes that are applicable across professions.

**PHMD 4585. Research Methods in Health Systems. (2 Hours)**

Exposes students to research skills and methods used by health system pharmacists when planning and conducting research. Builds on content from prior courses. Designed for students planning to pursue a career in a health system or the pharmaceutical industry. Focuses on discussion and application; taught by healthcare-system-based pharmacists actively involved in clinical research. Emphasizes the process used to generate robust research questions and research plans throughout. Uses practice statements/guidelines, published studies, patient databases, and faculty's current research projects to illustrate course topics.

**PHMD 4611. Comprehensive Disease Management 1. (6 Hours)**

Covers foundational concepts of pharmacy practice, including patient evaluation; identification of drug-related problems; pathophysiology; and clinical management of diseases of the respiratory, cardiovascular, and endocrine systems. Specifically covers asthma and COPD, hypertension, hyperlipidemia, diabetes, fluids/electrolytes, and renal disorders. Reviews, system-by-system, the mechanisms of these diseases and their evidence-based prevention and treatment strategies. Offers students an opportunity to apply scientific knowledge and principles of medicinal chemistry, pharmacology, pharmaceutics, and pharmacokinetics to the design of rational, evidence-based therapeutic strategies to provide care to patients in inpatient, ambulatory, and community settings. Emphasizes pathophysiology, self-care, patient education, assessment, medication administration, management, monitoring, and preventative health and population-based health outcomes.

**Prerequisite(s):** PHSC 4502 with a minimum grade of D- ; PHSC 3412 with a minimum grade of D- ; PHMD 2350 with a minimum grade of D-

**Corequisite(s):** PHMD 4612

**PHMD 4612. Comprehensive Disease Management 1 Seminar. (1 Hour)**

Designed to provide students with opportunities to apply concepts from PHMD 4611 to patient cases, special projects, and other medication-related issues focusing on foundational aspects of pharmacy practice, identification of drug-related problems, and diseases of the respiratory, endocrine, cardiovascular, and renal systems. Accompanies PHMD 4611 and seeks to facilitate accomplishment of course objectives using an active learning format. While completing seminar work, students are expected to review, discuss, integrate, and apply information presented in comprehensive disease management lectures and readings as well as previous and concurrent course work.

**Corequisite(s):** PHMD 4611

**PHMD 4621. Comprehensive Disease Management 2. (6 Hours)**

Covers the pathophysiology and clinical management of diseases of the renal, cardiovascular, neurological, and gastrointestinal systems. Reinforces foundational concepts of pharmacy practice and diseases covered in PHMD 4611, while completing a system-by-system review of the mechanisms of renal, cardiovascular, neurological, and gastrointestinal disorders and their evidence-based prevention and treatment strategies. Offers students an opportunity to design rational therapeutic strategies to provide care to patients with these disease states in inpatient, ambulatory, and community settings. Emphasizes pathophysiology, self-care, patient education, assessment, medication administration, management, monitoring, and preventative health and population-based health outcomes.

**Prerequisite(s):** PHSC 3430 with a minimum grade of D- ; PHMD 4611 with a minimum grade of D-

**Corequisite(s):** PHMD 4622, PHMD 4623

**PHMD 4622. Comprehensive Disease Management 2 Seminar. (1 Hour)**

Designed to provide students with opportunities to apply concepts from PHMD 4621 to patient cases, special projects, and other medication-related issues focusing on foundational aspects of pharmacy practice; identification of drug-related problems; and diseases of the renal, cardiovascular, neurological, and gastrointestinal systems. Accompanies PHMD 4621 and seeks to facilitate accomplishment of course objectives using an active-learning format. While completing seminar work, students are expected to review, discuss, integrate, and apply information presented in comprehensive disease management lectures and readings as well as previous and concurrent course work. Activities in seminar are reinforced by laboratory skill-building exercises in PHMD 4623.

**Corequisite(s):** PHMD 4621, PHMD 4623

**PHMD 4623. Comprehensive Disease Management 2 Skills Lab. (0.5 Hours)**

Offers a self-paced, blended learning experience designed to provide the student with functional knowledge and skills in the area of physical assessment, patient education, and counseling in the ambulatory clinic and community pharmacy settings. Uses discussions, videos, podcasts, simulations, and hands-on learning activities in the lab. Offers students an opportunity to apply information gained in previous and concurrent courses to clinical situations. While completing laboratory work, students are expected to review, discuss, integrate, and apply information presented in the closely aligned PHMD 4621 and PHMD 4622 as well as previous and concurrent course work.

**Corequisite(s):** PHMD 4621, PHMD 4622

**PHMD 4631. Comprehensive Disease Management 3. (6 Hours)**

Covers the pathophysiology and clinical management of infectious diseases, solid organ transplant, dermatology, and otic/ophthalmic disorders. Reinforces foundational concepts of pharmacy practice and diseases covered in PHMD 4611 and PHMD 4612, while completing a system-by-system review of the mechanisms of infectious diseases and their evidence-based prevention and treatment strategies. Offers students an opportunity to design rational therapeutic strategies to provide care to patients with these disease states in inpatient, ambulatory, and community settings. Emphasizes pathophysiology, self-care, patient education, assessment, medication administration, management, monitoring, and preventative health and population-based health outcomes.

**Prerequisite(s):** PHMD 4621 with a minimum grade of D-

**Corequisite(s):** PHMD 4632, PHMD 4633

**PHMD 4632. Comprehensive Disease Management 3 Seminar. (1 Hour)**

Designed to provide students with opportunities to apply concepts from PHMD 4631 to patient cases, special projects, and other medication-related issues focusing on foundational aspects of pharmacy practice, identification of drug-related problems, and management of the infectious diseases and dermatologic and oral/otic disorders. Accompanies PHMD 4631 and seeks to facilitate accomplishment of course objectives using an active-learning format. While completing seminar work, students are expected to review, discuss, integrate, and apply information presented in comprehensive disease management lectures and readings as well as previous and concurrent course work. Activities in seminar are reinforced by laboratory skill-building exercises in PHMD 4633.

**Corequisite(s):** PHMD 4631, PHMD 4633

**PHMD 4633. Comprehensive Disease Management 3 Skills Lab. (0.5 Hours)**

Teaches and assesses various skills, including interpretation, processing, and verification of medication orders; detection and resolution of drug-related problems; use of current pharmacy software programs; and patient education and counseling in the community pharmacy setting. Uses discussions, videos, podcasts, simulations, and hands-on learning activities in the lab. While completing laboratory work, students are expected to review, discuss, integrate, and apply information presented in the closely aligned PHMD 4631 and PHMD 4632 as well as previous and concurrent course work.

**Corequisite(s):** PHMD 4631, PHMD 4632

**PHMD 4641. Comprehensive Disease Management 4. (6 Hours)**

Covers the pathophysiology and clinical management of men's and women's health issues and neurological, psychiatric, and oncologic disorders. Reinforces foundational concepts of pharmacy practice and diseases covered in PHMD 4611, PHMD 4612, and PHMD 4613, while completing a system-by-system review of the mechanisms of infectious diseases and their evidence-based prevention and treatment strategies. Offers students an opportunity to design rational therapeutic strategies to provide care to patients with these disease states in inpatient, ambulatory, and community settings. Emphasizes pathophysiology, self-care, patient education, assessment, medication administration, management, monitoring, and preventative health and population-based health outcomes.

**Prerequisite(s):** PHMD 4631 with a minimum grade of D-

**Corequisite(s):** PHMD 4642, PHMD 4643

**PHMD 4642. Comprehensive Disease Management 4 Seminar. (1 Hour)**

Designed to provide students with opportunities to apply concepts from PHMD 4641 to patient cases, special projects, and other medication-related issues focusing on foundational aspects of pharmacy practice, identification of drug-related problems, and management of women's and men's disease, psychological disorders, and cancers. Accompanies PHMD 4641 and seeks to facilitate accomplishment of course objectives using an active-learning format. While completing seminar work, students are expected to review, discuss, integrate, and apply information presented in comprehensive disease management lectures and readings as well as previous and concurrent course work. Activities in seminar are reinforced by laboratory skill-building exercises in PHMD 4643.

**Corequisite(s):** PHMD 4641, PHMD 4643

**PHMD 4643. Comprehensive Disease Management 4 Skills Lab. (0.5 Hours)**

Teaches and assesses various skills, including interpretation, processing, and verification of medication orders; detection and resolution of drug-related problems; use of current pharmacy software programs; medication reconciliation; presentation of hospitalized patients; and management of sterile compounding systems in the hospital pharmacy setting. Uses discussions, videos, podcasts, simulations, and hands-on learning activities in the lab. While completing laboratory work, students are expected to review, discuss, integrate, and apply information presented in the closely aligned PHMD 4641 and PHMD 4642 as well as previous and concurrent course work.

**Corequisite(s):** PHMD 4641, PHMD 4642

**PHMD 4700. Principles in General Medicine. (2 Hours)**

Offers students an opportunity to apply concepts learned in comprehensive-disease-management modules to patient cases, special projects, and other medication-related problems in an active-learning environment. Creates an environment similar to that of acute care advanced pharmacy practice experiences (APPEs) to enable students to gain familiarity and confidence in disease-state management, oral communication skills, and professional behavior and interactions. Focuses on oral presentations and communication skills, which is similar to how students are evaluated on clinically based rotations; students are also evaluated by quizzes and exams to measure mastery of content-specific objectives.

**PHMD 4890. Contemporary Issues in Geriatric Pharmacy. (2 Hours)**

Focuses on the physiological and practical aspects of medication use in the elderly; healthcare delivery systems; the role of healthcare professionals in providing geriatric care; and the management of geriatric syndromes. Caring for the aging population requires a patient-centered approach that encompasses the patient's health goals, a complex psychosocial landscape, as well as the physiologic changes associated with aging. It is imperative for healthcare professionals to understand the interplay of these factors in order to appropriately assess, treat, and improve outcomes for the older adult population. Offers students an opportunity to utilize problem-based learning (PBL), where students work in groups to analyze patient cases, identify problems, and develop action plans to resolve problems.

**PHMD 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**PHMD 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** PHMD 4970 with a minimum grade of D-

**PHMD 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHMD 5115. Integrated Science and Therapeutics 2. (4 Hours)**

Integrates foundational concepts of pharmacology, medicinal chemistry, pathophysiology, and pharmacotherapeutics to treat patients with acute and chronic cardiovascular, renal, and gastrointestinal diseases. Studies knowledge, skills, and attitudes pertaining to drug action, drug-receptor interactions, structure-activity relationships, dose-response relationships, drug mechanisms of action, therapeutic uses, and adverse effects. Offers students an opportunity to develop patient evaluation skills using the Pharmacists' Patient Care Process and identification of drug therapy problems. Emphasizes self-care, patient education, assessment, medication administration, management and monitoring, and preventative health and population-based health outcomes.#.

**Prerequisite(s):** (PHSC 5110 with a minimum grade of D- ; PHSC 5181 with a minimum grade of D- ; PHMD 5191 with a minimum grade of D- ) or graduate program admission

**PHMD 5120. Principles of Pharmacy Practice. (4 Hours)**

Introduces policies, procedures, and expectations of the experiential program. Offers students an opportunity to prepare for their first introductory pharmacy practice experience by developing knowledge, attitudes, and communications skills needed to be successful in all components of the experiential program. Exposes students to various IPPE/co-op opportunities, as well as potential career paths, within pharmacy. Covers workplace issues including diversity, sexual harassment, ethics, and confidence of information; resumé preparation; and interviewing techniques. Introduces technical knowledge and skills required for IPPE/co-op in community and institutional settings and drug information resources.

**PHMD 5140. Integrated Social and Administrative Sciences 1. (4 Hours)**

Explores foundational concepts in social and administrative sciences, examining the organization and function of American healthcare systems. Assesses the impacts of system-level actions on individual patients. Offers students an opportunity to build skills in understanding specific drug information needs and finding and conveying this information. Compares and contrasts approaches for successful verbal and nonverbal communication among pharmacists, patients, and other health professionals across diverse situations. Evaluates American legal frameworks that establish standards for pharmacy practice today.

**PHMD 5182. Integrated Learning Lab 2. (1 Hour)**

Offers students an opportunity to develop and assimilate knowledge, skills, and attitudes related to the pharmaceutical care of patients to supplement and augment pharmacy curricular topics within an immersive learning experience. Includes pharmacology, medicinal chemistry, pathophysiology, and therapeutics of cardiovascular diseases. Uses innovative digital tools, environments, equipment, learning materials, and pedagogical methods that promote the development and refinement of problem-solving skills, adaptability/resilience, and a team mindset that can be applied during experiential activities (co-op/introductory pharmacy practice experience/advanced pharmacy practice experience), as well as future careers.

**PHMD 5191. Concepts in Practice 1. (1 Hour)**

Applies concepts through activities designed to develop knowledge, skills, and attitudes focused on foundational aspects of pharmacy practice. Covers identification of drug-related problems, problem solving, and disease state management. Focuses on patient assessment and common cardiovascular diseases. Reviews, discusses, synthesizes, and applies information from current and previous coursework and experiential activities in an active-learning format.

**PHMD 5192. Concepts in Practice 2. (1 Hour)**

Applies concepts through activities designed to develop knowledge, skills, and attitudes focused on foundational aspects of pharmacy practice. Covers identification of drug-related problems, problem solving, and disease state management. Focuses on advanced cardiovascular diseases such as myocardial infarction, arrhythmias, and renal and gastrointestinal diseases. Reviews, discusses, synthesizes, and applies information from current and previous coursework and experiential activities in an active-learning format.

**PHMD 5210. Integrated Science and Therapeutics 4. (4 Hours)**

Integrates foundational concepts of pharmacology, medicinal chemistry, pathophysiology, immunology, microbiology, and pharmacotherapeutics to treat patients with acute and chronic bacterial and fungal infectious diseases. Offers students an opportunity to develop knowledge, skills, and attitudes pertaining to drug action, drug-receptor interactions, structure-activity relationships, dose-response relationships, drug mechanisms of action, therapeutic uses, and adverse effects. Focuses on developing patient evaluation skills using the Pharmacists' Patient Care Process and identification of drug therapy problems. Emphasizes self-care, patient education, assessment, medication administration, management, and monitoring, as well as preventative health and population-based health outcomes.#.

**Prerequisite(s):** (PHSC 5205 with a minimum grade of D- ; PHMD 5283 with a minimum grade of D- ; PHMD 5293 with a minimum grade of D- ) or graduate program admission

**PHMD 5215. Integrated Science and Therapeutics 5. (4 Hours)**

Integrates foundational concepts of pharmacology, medicinal chemistry, pathophysiology, immunology, and pharmacotherapeutics to treat patients with viral infectious diseases, organ transplant, and self-care therapeutics. Offers students an opportunity to develop knowledge, skills, and attitudes pertaining to drug action, drug-receptor interactions, structure-activity relationships, dose-response relationships, drug mechanisms of action, therapeutic uses, and adverse effects. Focuses on developing patient evaluation skills using the Pharmacists' Patient Care Process and identification of drug therapy problems. Emphasizes self-care, patient education, assessment, medication administration, management, and monitoring, as well as preventative health and population-based health outcomes.##.

**Prerequisite(s):** (PHSC 5205 with a minimum grade of D- ; PHMD 5283 with a minimum grade of D- ; PHMD 5293 with a minimum grade of D- ) or graduate program admission

**PHMD 5220. Integrated Science and Therapeutics 6. (4 Hours)**

Integrates foundational concepts of pharmacology, medicinal chemistry, pathophysiology, and pharmacotherapeutics to treat patients with acute and chronic pain and neurologic and psychiatric diseases. Offers students an opportunity to develop knowledge, skills, and attitudes pertaining to drug action, drug-receptor interactions, structure-activity relationships, dose-response relationships, drug mechanisms of action, therapeutic uses, and adverse effects. Focuses on developing patient evaluation skills using the Pharmacists' Patient Care Process and identification of drug therapy problems. Emphasizes self-care, patient education, assessment, medication administration, management, and monitoring, as well as preventative health and population-based health outcomes.##.

**Prerequisite(s):** (PHMD 5210 with a minimum grade of D- ; PHMD 5215 with a minimum grade of D- ; PHMD 5284 with a minimum grade of D- ; PHMD 5294 with a minimum grade of D- ) or graduate program admission

**PHMD 5223. Evidence-Based Medicine. (2 Hours)**

Studies the principles of evidence-based medicine and how to apply them to patient-centered care. Offers students an opportunity to develop skills in critical appraisal of the scientific literature and practical application of the evidence to clinical decision making. Consists of didactic instruction, in-class group projects, and a group-based written assignment. Applies principles of research methodology, biostatistics, and professional writing.

**Prerequisite(s):** (ENGW 3306 with a minimum grade of C or graduate program admission)

**Attribute(s):** NUpath Writing Intensive

**PHMD 5225. Medical Writing. (2 Hours)**

Introduces concepts and principles of effective scientific writing and communication of clinical information to health professionals and the scientific community. Examines a variety of scientific genres that provide context to common writing techniques and conventions employed. Emphasizes developing expertise in critical research, data evaluation and synthesis, audience analysis, peer review, revision, and evidence-based summaries and conclusions. Provides opportunity to develop necessary skills to effectively synthesize scientific evidence and write and communicate to a variety of scientific audiences. Designed for those who will encounter a spectrum of scientific writing throughout their careers.

**Prerequisite(s):** ENGW 3306 with a minimum grade of C or graduate program admission

**PHMD 5240. Integrated Social and Administrative Sciences 2. (4 Hours)**

Provides a foundation in research methodology, drug information skills, and evidence-based medicine in an interactive format. Emphasizes research designs used in experimental and observational studies, hypothesis testing, and basic biostatistics, along with the critical examination of articles to analyze research questions and methods related to validity, generalizability, and ethical issues in design and conduct. Uses clinical trials, observational studies, and problem sets to illustrate principles of research design, conduct, data analysis, and evaluation. Emphasizes development of applied drug information skills in formulary support, health informatics, medication error and adverse event reporting, and quality assurance, as well as writing for a variety of audiences (pharmacists, healthcare providers, and the lay public) and use of peer review.

**Prerequisite(s):** (PHMD 5140 with a minimum grade of D- ; PHMD 5182 with a minimum grade of D- ; PHMD 5192 with a minimum grade of D- ) or graduate program admission

**Attribute(s):** NUpath Ethical Reasoning, NUpath Natural/Designed World, NUpath Writing Intensive

**PHMD 5245. Integrated Social and Administrative Sciences 3. (4 Hours)**

Describes managerial, administrative, and leadership skills essential for a contemporary pharmacist. Uses general business principles as a foundation for applications to common pharmacy practice settings, with an emphasis on community and hospital pharmacy. Offers students opportunities to participate in projects and group work designed to facilitate understanding and applications of managerial, administrative, leadership, and entrepreneurship principles to pharmacy practice. Emphasizes enhanced development of applied drug information skills important to the pharmacist in areas of formulary support, health informatics, medication error and adverse event reporting, and quality assurance. Covers analysis and evaluation of laws, rules, and regulations controlling pharmacy practice related to medication dispensing.

**Prerequisite(s):** (PHMD 5240 with a minimum grade of D- ; PHMD 5283 with a minimum grade of D- ; PHMD 5293 with a minimum grade of D- ) or graduate program admission

**PHMD 5250. Pharmacy Care Management. (4 Hours)**

Focuses on the managerial and administrative skills required by a contemporary pharmacist practicing in either a community or hospital setting. Covers classical management principles of planning, decision making, organizing, hiring, and controlling. Case study methods are used as an interactive teaching tool. Also covers pertinent current events.

**Prerequisite(s):** PHMD 2350 with a minimum grade of C

**PHMD 5270. Economic Evaluation of Pharmaceuticals and Pharmacy Practice. (2 Hours)**

Introduces the principles of economic theory of healthcare markets and economic evaluation of health products and services. Economic theory topics include fundamentals of supply and demand, market structure, market failure, and the role of government. Economic evaluation topics include measuring costs and benefits of a specific treatment, types of formal decision analysis, ethical considerations, and implementation in the real world. Restricted to students with fifth-year PharmD standing.

**Prerequisite(s):** (PHMD 4631 with a minimum grade of C- or PHMD 4631 with a minimum grade of D- ); (PHMD 4632 with a minimum grade of C- or PHMD 4632 with a minimum grade of D- )

**PHMD 5282. Integrated Learning Lab 2. (1 Hour)**

Offers students an opportunity to develop and assimilate knowledge, skills, and attitudes related to the pharmaceutical care of patients to supplement and augment pharmacy curricular topics within an immersive learning experience. Includes pharmacology, medicinal chemistry, pathophysiology, and therapeutics of cardiovascular diseases. Uses innovative digital tools, environments, equipment, learning materials, and pedagogical methods that promote the development and refinement of problem-solving skills, adaptability/resilience, and a team mindset that can be applied during experiential activities (co-op/introductory pharmacy practice experience/advanced pharmacy practice experience), as well as future careers.

**PHMD 5283. Integrated Learning Lab 3. (1 Hour)**

Offers students an opportunity to develop and assimilate knowledge, skills, and attitudes related to the pharmaceutical care of patients to supplement and augment pharmacy curricular topics within an immersive learning experience. Includes pharmacokinetics; professional communication skills; drug information; jurisprudence; research methods; patient counseling; and pharmacology, immunology, medicinal chemistry, pathophysiology, and therapeutics of chronic rheumatologic, immune-mediated, dermatologic, and oncologic diseases. Uses innovative digital tools, environments, equipment, learning materials, and pedagogical methods that promote development and refinement of problem-solving skills, adaptability/resilience, and a team mindset that can be applied during experiential activities (co-op/introductory pharmacy practice experience/advanced pharmacy practice experience), as well as future careers.

**PHMD 5284. Integrated Learning Lab 4. (1 Hour)**

Offers students an opportunity to develop and assimilate knowledge, skills, and attitudes related to the pharmaceutical care of patients to supplement and augment pharmacy curricular topics within an immersive learning experience. Includes professional communication skills; drug information; management; jurisprudence; patient counseling; aseptic technique/compounding; and pharmacology, immunology, medicinal chemistry, pathophysiology, and therapeutics of acute and chronic infectious diseases. Uses innovative digital tools, environments, equipment, learning materials, and pedagogical methods that promote the development and refinement of problem-solving skills, adaptability/resilience, and a team mindset that can be applied during experiential activities (co-op/introductory pharmacy practice experience/advanced pharmacy practice experience), as well as future careers.

**PHMD 5285. Integrated Learning Lab 5. (1 Hour)**

Offers students an opportunity to develop and assimilate knowledge, skills, and attitudes related to the pharmaceutical care of patients to supplement and augment pharmacy curricular topics within an immersive learning experience. Includes professional communication skills; drug information; jurisprudence; patient counseling; pharmacology, medicinal chemistry, and pathophysiology; and therapeutics of acute and chronic neurologic, pain, and psychiatric diseases. Uses innovative digital tools, environments, equipment, learning materials, and pedagogical methods that promote the development and refinement of problem-solving skills, adaptability/resilience, and a team mindset that can be applied during experiential activities (co-op/introductory pharmacy practice experience/advanced pharmacy practice experience), as well as future careers.

**PHMD 5293. Concepts in Practice 3. (1 Hour)**

Applies concepts through activities designed to develop knowledge, skills, and attitudes focused on foundational aspects of pharmacy practice. Covers identification of drug-related problems, problem solving, and disease state management related to the pharmaceutical care of patients with a focus on pharmacokinetics and chronic rheumatologic, immune-mediated, dermatologic, and oncologic diseases. Reviews, discusses, synthesizes, and applies information from current and previous coursework and experiential activities in an active learning format.

**PHMD 5294. Concepts in Practice 4. (1 Hour)**

Applies concepts through activities designed to develop knowledge, skills, and attitudes focused on foundational aspects of pharmacy practice. Covers identification of drug-related problems, problem solving, and disease state management related to the pharmaceutical care of patients with a focus on acute and chronic infectious diseases. Reviews, discusses, synthesizes, and applies information from current and previous coursework and experiential activities in an active learning format.

**PHMD 5295. Concepts in Practice 5. (1 Hour)**

Applies concepts through activities designed to develop knowledge, skills, and attitudes focused on foundational aspects of pharmacy practice. Covers identification of drug-related problems, problem solving, and disease state management related to the pharmaceutical care of patients with a focus on acute and chronic neurologic pain and psychiatric diseases. Reviews, discusses, synthesizes, and applies information from current and previous coursework and experiential activities in an active learning format.

**PHMD 5320. APPE Readiness. (4 Hours)**

Designed to prepare students for Advanced Pharmacy Practice Experiences. Builds upon and assesses knowledge, skills, and attitudes developed during the first three years of the Doctor of Pharmacy curriculum. Offers learning activities and assessments that simulate student responsibilities during an APPE including interprofessional collaborations, caring for diverse patient populations in different settings, communicating with care team members, and assessing evidence to support informed recommendations and educational interventions for patients. Utilizes a continuous professional development and lifelong learning plan and reflection on skill development to set goals for APPE and postgraduation.

**Corequisite(s):** PHMD 5335

**Attribute(s):** NUpath Capstone Experience

**PHMD 5330. Jurisprudence. (3 Hours)**

Examines how federal and state regulatory bodies, statutes, laws, regulations, policies, guidance, and practice guides set the standard for the present-day practice of pharmacy.

**Prerequisite(s):** PHMD 4611 with a minimum grade of C- or PHMD 4611 with a minimum grade of C-

**PHMD 5335. Integrated Science and Therapeutics 7. (4 Hours)**

Integrates foundational concepts of pharmacology, medicinal chemistry, pathophysiology, and pharmacotherapeutics to treat patients with acute and chronic conditions with men's and women's health, endocrine, and thyroid disorders. Offers students an opportunity to develop knowledge, skills, and attitudes pertaining to drug action, drug-receptor interactions, structure-activity relationships, dose-response relationships, drug mechanisms of action, therapeutic uses, and adverse effects. Focuses on developing patient evaluation skills using the Pharmacists' Patient Care Process and identification of drug therapy problems. Emphasizes self-care, patient education, assessment, medication administration, management, and monitoring, as well as preventative health and population-based health outcomes.#.

**Prerequisite(s):** (PHMD 5220 with a minimum grade of D- ; PHMD 5285 with a minimum grade of D- ; PHMD 5295 with a minimum grade of D- ) or graduate program admission

**PHMD 5345. Integrated Social and Administrative Sciences 4. (4 Hours)**

Introduces the principles of economic theory of healthcare, pharmaceutical markets, and economic evaluation of health products and services. Economic theory topics include fundamentals of supply and demand, market structure, market failure, and the role of government, with a focus on pharmaceutical products and market. Economic evaluation topics include measuring costs and benefits of a specific treatment, types of formal decision analysis, ethical considerations, and implementation in the real world. Studies advanced development of applied drug information skills important to the pharmacist in areas of formulary support, health informatics, medication error and adverse event reporting, and quality assurance. Covers analysis and evaluation of laws, rules, and regulations controlling pharmacy practice related to medication dispensing.

**Prerequisite(s):** (PHMD 5245 with a minimum grade of D- ; PHMD 5285 with a minimum grade of D- ; PHMD 5295 with a minimum grade of D- ) or graduate program admission

**PHMD 5386. Integrated Learning Lab 6. (1 Hour)**

Offers students an opportunity to develop and assimilate knowledge, skills, and attitudes related to the pharmaceutical care of patients to supplement and augment pharmacy curricular topics within an immersive learning experience. Includes professional communication skills, drug information, jurisprudence, patient counseling, pharmacoeconomics, pharmacology, medicinal chemistry, pathophysiology, and therapeutics of acute and chronic conditions with men/women's health, endocrine, and thyroid disorders. Uses innovative digital tools, environments, equipment, learning materials, and pedagogical methods that promote the development and refinement of problem-solving skills, adaptability/resilience, and a team mindset that can be applied during experiential activities (co-op/introductory pharmacy practice experience/advanced pharmacy practice experience), as well as future careers.

**PHMD 5396. Concepts in Practice 6. (1 Hour)**

Applies concepts through activities designed to develop knowledge, skills, and attitudes focused on foundational aspects of pharmacy practice. Covers identification of drug-related problems, problem solving, and disease state management related to the pharmaceutical care of patients with a focus on acute and chronic conditions with men/women's health, endocrine, and thyroid diseases. Reviews, discusses, synthesizes, and applies information from current and previous coursework and experiential activities in an active-learning format.

**PHMD 5405. Hematology and Oncology Pharmacotherapy. (2 Hours)**

Emphasizes the role of pharmacotherapy in the management of hematologic and oncologic diseases. Provides a comprehensive overview of benign and malignant hematologic diseases and solid tumor malignancies, as well as their corresponding treatment modalities.

**PHMD 5450. Advanced Pharmacy Practice Experience Preparatory Seminar. (1 Hour)**

Offers students an opportunity to collect relevant information to make informed decisions concerning the selection of advanced pharmacy practice experiences (APPEs). Designed to provide new knowledge (e.g., what is expected of a P4 student) and to strengthen existing knowledge (e.g., from didactic courses) to offer a smooth transition from the didactic courses to APPEs.

**PHMD 5560. Applied Drug Information. (2 Hours)**

Offers students an opportunity to obtain the skills necessary to become effective providers of drug information. An effective provider assesses drug information needs and evaluates, applies, and communicates data from the published literature and other sources to optimize patient care. Designed to help students develop applied drug information skills important to the pharmacist in areas of formulary support, health informatics, medication error and adverse event reporting, and quality assurance. Students complete a variety of active learning exercises, including multiple evidence-based written drug information responses and a current events analysis. Emphasizes writing for a variety of audiences, including pharmacists, other healthcare providers, and the lay public, as well as use of peer review.

**Prerequisite(s):** ENGW 3306 with a minimum grade of C or graduate program admission

**Attribute(s):** NUpath Writing Intensive

**PHMD 5575. Pharmaceutical Industry. (2 Hours)**

Offers a global overview of pharmaceutical industry career options and pathways. Focuses on all major functions of the industry, such as clinical research and medical affairs. Additional areas covered include regulatory affairs, health economic and outcomes research, marketing, sales, scientific liaisons, and pharmacovigilance. Explores the phases of drug development and how these phases interact with different departments.

**PHMD 5600. Pharmacy Capstone. (4 Hours)**

Acts as a final integrator of the major, general education, and experiential aspects of the student's education. Expects students to demonstrate motivation and initiative and to work cooperatively with their faculty mentor, community partners, and fellow students (where applicable) in order to complete a comprehensive, high-quality scholarly work (e.g., a research project, educational project, administrative project, business plan, case report, or community-service learning project or professional manuscript) appropriate for dissemination to the university and professional community. The timeline for completion is set by the faculty mentor and agreed to by the individual or all members of the student group. May be repeated once.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PHMD 5800. Navigating Over-the-Counter Products and Self-Care Practices Inside and Outside the United States. (4 Hours)**

Offers health profession learners an opportunity to develop a basic understanding of health-delivery systems, specific to pharmacy practices, and key issues confronting healthcare inside and outside (e.g., Norway, Spain, Portugal, Australia, etc.) of the United States. Explores issues such as the delivery and affordability of medical care and pharmaceutical products, patient rights, health risks and behaviors, disease prevention, and quality and access to care. Compares and contrasts key healthcare issues inside and outside of the United States using literature resources, internet and contemporary media, observations in the study countries, discussions with guest speakers/cocurricular cultural events, and incorporation of self- and group-reflection activities.

**PHMD 5880. Special Topics. (2,3 Hours)**

Explores topics germane to medication and medication use, as established by the course instructor.

**PHMD 5976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated for up to 4 total credits.

**PHMD 5984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**PHMD 6440. Internal Medicine Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in the hospital setting. In collaboration with other members of the healthcare team, and under the supervision of a clinical preceptor, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients.

**PHMD 6441. Acute Care Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients. In collaboration with other members of the healthcare team, and under the supervision of a clinical preceptor, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients.

**PHMD 6442. Ambulatory Care Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in an ambulatory clinic environment. In collaboration with other members of the healthcare team, and under the supervision of a clinical preceptor, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients.

**PHMD 6443. Community Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in a community setting. In collaboration with other members of the healthcare team, and under the supervision of a clinical preceptor, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients.

**PHMD 6444. Internal Medicine Elective Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in the hospital setting. In collaboration with other members of the healthcare team, and under the supervision of a clinical preceptor, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated once.

**PHMD 6445. Ambulatory Care Elective Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in an ambulatory clinic environment. In collaboration with other members of the healthcare team, and under the supervision of a clinical preceptor, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated without limit.

**PHMD 6446. Psychiatry Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients under psychiatric care. In collaboration with other members of the healthcare team, and under the supervision of a clinical preceptor, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated without limit.

**PHMD 6447. Community Elective Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in a community setting. In collaboration with other members of the healthcare team, and under the supervision of a clinical preceptor, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated without limit.

**PHMD 6448. Long-Term Care Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in a nursing home or rehabilitation center. Under the supervision of a clinical preceptor and, when appropriate, in conjunction with other members of the healthcare team, identifies appropriate drug therapy and monitoring requirements for common pathophysiologic processes and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated up to nine times.

**PHMD 6449. Geriatrics Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in a geriatric practice setting. Under the supervision of a clinical preceptor, and, when appropriate, in conjunction with other members of the healthcare team, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated without limit.

**PHMD 6450. Pediatrics Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in a pediatric practice setting. Under the supervision of a clinical preceptor, and, when appropriate, in conjunction with other members of the healthcare team, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated without limit.

**PHMD 6451. Neonatology Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in a neonatal practice setting. Under the supervision of a clinical preceptor, and, when appropriate, in conjunction with other members of the healthcare team, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated without limit.

**PHMD 6452. Critical Care Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in a critical-care practice setting. Under the supervision of a clinical preceptor, and, when appropriate, in conjunction with other members of the healthcare team, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated without limit.

**PHMD 6453. Surgery Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in a surgical practice setting. Under the supervision of a clinical preceptor, and, when appropriate, in conjunction with other members of the healthcare team, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated without limit.

**PHMD 6454. Cardiology Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in a cardiology practice setting. Under the supervision of a clinical preceptor, and, when appropriate, in conjunction with other members of the healthcare team, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated without limit.

**PHMD 6456. Drug Information Advanced Pharmacy Practice Experience. (6 Hours)**

Applies drug information skills to site-specific drug information requests under the supervision of a clinical preceptor, and, when appropriate, in conjunction with other members of the site team. Using appropriate sources, the student analyzes drug information findings, such as dosing, monitoring, indications, efficacy, and adverse drug reactions. May be repeated without limit.

**PHMD 6457. Oncology Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in an oncology practice setting. Under the supervision of a clinical preceptor, and, when appropriate, in conjunction with other members of the healthcare team, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated without limit.

**PHMD 6461. Infectious Disease Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients on an infectious disease consult service. Under the supervision of a clinical preceptor, and, when appropriate, in conjunction with other members of the healthcare team, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated without limit.

**PHMD 6462. Pharmacy Industry Advanced Pharmacy Practice Experience. (6 Hours)**

Focuses on the application of regulatory affairs and healthcare principles in the pharmaceutical industry. Under the supervision of a preceptor, and, when appropriate, in conjunction with other members of the site team, participates in appropriate activities, such as drug research and development, marketing, medical affairs, regulatory affairs, and information service. May be repeated without limit.

**PHMD 6463. Pharmacy Administration Advanced Pharmacy Practice Experience. (6 Hours)**

Applies healthcare and management principles, with emphasis on pharmacy administration, under the supervision of a preceptor, and, when appropriate, in conjunction with other members of the site team. May be repeated without limit.

**PHMD 6464. Regulatory Advanced Pharmacy Practice Experience. (6 Hours)**

Participates in appropriate activities including but not limited to principles of and compliance with pharmacy law and review of regulations governing the FDA's mandatory reporting of adverse drug reactions under the supervision of a preceptor, and, when appropriate, in conjunction with other members of the site team. In addition, students may have the opportunity to be given a step-by-step introduction to public record laws, Board Regulations at 247 CMR, and pharmacy statutes at Massachusetts General Laws, Chapter 112, 24(A)–42(A). May be repeated without limit.

**PHMD 6465. Managed Care Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in a managed-care practice setting. Under the supervision of a clinical preceptor, and, when appropriate, in conjunction with other members of the healthcare team, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated without limit.

**PHMD 6466. Transplantation Advanced Pharmacy Practice Experience. (6 Hours)**

Applies principles of pathophysiology, therapeutics, and communication to the pharmacy-care management of individual patients in a transplantation unit. Under the supervision of a clinical preceptor, and, when appropriate, in conjunction with other members of the healthcare team, offers identification of appropriate drug therapy and monitoring requirements for common pathophysiologic processes, and, when indicated, modification of population-based treatment strategies based on the unique characteristics of individual patients. May be repeated without limit.

**PHMD 6467. Directed Practice Advanced Pharmacy Practice Experience. (6 Hours)**

Offers nontraditional experience with an approved preceptor at an appropriate site. Based on availability. May be repeated without limit.

**PHMD 6468. International Advanced Pharmacy Practice Experience. (6 Hours)**

Offers an international experience with an approved preceptor at an appropriate site. Based on availability. May be repeated up to four times.

**PHMD 6469. Management Advanced Pharmacy Practice Experience. (6 Hours)**

Offers students an opportunity to apply healthcare and management principles, with an emphasis on pharmacy management, under the supervision of a preceptor and, when appropriate, in conjunction with other members of the site management team. May be repeated up to two times.

**PHMD 6470. Education Advanced Pharmacy Practice Experience. (6 Hours)**

Offers students an opportunity to teach in the pharmacy curriculum under the supervision of a faculty member. Students have an opportunity to examine how teachers use experience-based and problem-based approaches to engage the range of student learners (third- through fifth-year pharmacy students) to attain their learning goals. May be repeated up to two times.

**PHMD 6471. Research 1 Advanced Pharmacy Practice Experience. (6 Hours)**

Offers students interested in gaining basic or clinical research experience an opportunity to work under the direction of an experienced researcher at an appropriate site. Students can elect either a basic science (lab-based) preceptor or a clinical (patient-based) preceptor. Students can expect to be an active participant in a variety of different research activities and experiences that are deemed appropriate by the preceptor. The research efforts of the student may result in a peer-reviewed research abstract and/or presentation. May be repeated up to two times.

**PHMD 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHMD 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**PhD Experiential Leadership (PHDL)****PHDL 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHDL 7600. Leading Self and Others. (4 Hours)**

Inculcates students with knowledge, self-awareness, skills, and attitudes to effectively influence others, to lead teams, and to be productive team members by leading from the middle. Requires engagement with an outside organization to scope a project with organizational value that is complementary to the PhD dissertation requiring the PhD student to move out of their comfort zones. At completion of this course, successful students should demonstrate the ability to Influence others in leading teams and producing reliable and practical value to a sponsoring organization; appropriately apply methods in defining clear objectives, desired outcomes, and identifying and addressing customer needs in solving problems requiring breadth and depth in scientific and technical realms; and articulate the purpose, goals, and milestones of their Experiential PhD Leadership Challenge project. Requires acceptance into the Experiential PhD Leadership Certificate program.

**PHDL 7660. Experiential PhD Challenge Project 1. (4 Hours)**

Offers PhD students an opportunity to use research expertise in an authentic setting and with authentic consequences to develop and present a plan for the demonstration of an organizational challenge. This challenge can consist of a technology solution, a policy analysis with recommendations, or a review of organizational processes that involve higher-order critical thinking. Requires engagement and training with a sponsoring organization to improve a process, assess opportunity, or propose a solution that is of significant value to the organization and demonstrates a measurable impact while enhancing the PhD student's PhD education and intellectual agility while fostering leadership development. Requires acceptance into the Experiential PhD Leadership Certificate program.

**Prerequisite(s):** PHDL 7600 (may be taken concurrently) with a minimum grade of C-

**PHDL 7662. Experiential PhD Challenge Project 2. (4 Hours)**

Continues PHDL 7660. Offers an authentic experience in an authentic setting to develop and present a plan for the demonstration of an organizational challenge and produce a written documentary report on the project to the satisfaction of an advising committee. Requires engagement and training with a sponsoring organization to improve a process and assess opportunity or a proposal solution that is of significant value to the organization and demonstrates a measurable impact while enhancing the PhD student's PhD education and intellectual agility while fostering leadership development. Requires acceptance into the Experiential PhD Leadership Certificate program.

**Prerequisite(s):** PHDL 7660 (may be taken concurrently) with a minimum grade of C-

**PHDL 7664. Experiential PhD Challenge Project Continuation. (0 Hours)**

Continues PHDL 7662. Offers an authentic experience in an authentic setting to develop and present a plan for the demonstration of an organizational challenge and produce a written documentary report on the project to the satisfaction of an advising committee. Requires engagement and training with a sponsoring organization to improve a process and assess opportunity or a proposal solution that is of significant value to the organization and demonstrates a measurable impact while enhancing the PhD student's PhD education and intellectual agility while fostering leadership development.

**PHDL 7666. Contextual Integration. (0 Hours)**

Reflects on the manifestation of leadership styles, power and influence, and situational leadership observed through the Leadership Challenge. While executing the Challenge Project, students complete a series of self-directed modules providing opportunities for learning, growth, and interaction within their sponsoring organization. Modules include organizational leadership, leadership characteristics, developing project management skills, challenges to enhance leadership skills, report on experience and accomplishments, impact of academic research groups on external world, and vice versa. At the completion of their project and modules, students reflect on their development and accomplishments as part of a formal presentation to program faculty and fellow students. This presentation is available for incorporation into the student's PhD defense, and the accompanying report becomes a chapter in the student's dissertation. Requires acceptance into the Experiential PhD Leadership Certificate program.

**Prerequisite(s):** PHDL 7662 (may be taken concurrently) with a minimum grade of C- or PHDL 7664 (may be taken concurrently) with a minimum grade of C-

**PHDL 8950. Applied Teaching Fundamentals. (0 Hours)**

Offers new, intermediate-, or terminal-level PhD students who are engaged in teaching activities an opportunity to obtain the knowledge, skills, and competencies needed to design and facilitate engaging and meaningful student-centered learning experiences. Consists of a teaching practicum, pedagogical training, and structured peer and mentor support. Offers students an opportunity to reflect upon the practice of teaching, as well as hands-on experience engaging in all of the typical activities associated with teaching a course. Requires English proficiency at the level set by individual program and/or college guidelines. May be repeated four times.

## Philosophy (PHIL)

**PHIL 1000. Philosophy at Northeastern. (1 Hour)**

Intended for freshmen in the College of Social Sciences and Humanities. Introduces freshmen to the liberal arts in general; familiarizes them with their major; helps them develop the academic skills necessary to succeed (analytical ability and critical thinking); provides grounding in the culture and values of the University community; and helps them develop interpersonal skills—in short, familiarizes students with all skills needed to become a successful university student.

**PHIL 1101. Introduction to Philosophy. (4 Hours)**

Introduces students to philosophy by acquainting them with the theories and arguments of classical and contemporary philosophers and by teaching skills of constructing and analyzing arguments. Emphasizes philosophical inquiry. Topics include the basis of morality, free will vs. determinism, the existence of God, the problem of suffering, and the nature of knowledge.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 1102. Introduction to Contemporary Moral Issues. (4 Hours)**

Focuses on current controversial issues and moral debates. Specific topics vary but include subjects like abortion, euthanasia, global poverty, economic justice, affirmative action, gender relations, animal rights, the environment, the death penalty, war, cloning, and same-sex marriage. Offers an opportunity to learn to apply both the methods of philosophical analysis and various ethical and political theories to these controversies.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 1104. Goddesses, Witches, Saints, and Sinners: Women and Religion. (4 Hours)**

Introduces and examines the theory that Near Eastern and European religions were originally goddess centered through analyses of image, text, and ritual in the ancient world. Explores scholarship about the patriarchalization of these primal religions. Includes a consideration of scripture such as the Hebrew Bible, Greek Testament, and Qu'ran, as well as noncanonical texts.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**PHIL 1105. Science and Pseudoscience. (4 Hours)**

Examines the distinction between science and pseudoscience, how scientific theories change over time, the limits of scientific explanation, and whether or not scientific practice is rational and objective. What makes a theory scientific? Does culture influence scientific reasoning? What separates Einstein's theory of relativity and astrological horoscopes? Covers a variety of topics in the history of science such as the Copernican revolution and the practice of psychoanalysis. Also covers contemporary issues regarding the scientific status of IQ tests, intelligent design theory, and others.

**Attribute(s):** NUpath Interpreting Culture, NUpath Natural/Designed World

**PHIL 1110. Introduction to Religious Studies. (4 Hours)**

Examines the methods, disciplines, and theories employed in the academic study of religion. Focuses on major theories of religion employed in the discipline of religious studies, including historical, psychological, anthropological, and sociological approaches. Introduces students to the primary methods of research in the academic study of religion.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**PHIL 1111. Introduction to World Religions. (4 Hours)**

Offers a historical and thematic overview of the most widely recognized religions in the world today: Christianity, Judaism, Islam, Hinduism, and Buddhism. Focuses on the formative periods and historical developments of the great religions, ritual practices, and the differing ways in which they answer the fundamental religious questions. Considers ways in which religious practitioners have attempted to understand the nature of the world, human society, and a person's place within them.

**Attribute(s):** NUpath Difference/Diversity, NUpath Ethical Reasoning

**PHIL 1112. Debating Ethical Controversies. (4 Hours)**

Introduces students to the fundamentals of moral theory; ethical reasoning; social and political philosophy; as well as theories of social, political, and institutional change. Emphasizes in-depth ethical analysis and evaluation of the issues studied, their social and historical sources and context, as well as the way in which responses to them can and should lead to institutional and policy changes. Offers students an opportunity to be selected for an off-campus competitive debate experience. This course is modeled after the Intercollegiate Ethics Bowl debates on current social and ethical issues.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 1115. Introduction to Logic. (4 Hours)**

Covers the fundamentals of (formal) deductive and inductive logic. Begins with a thorough treatment of Boolean (i.e., truth-functional or propositional) logic, which provides the foundation for both mathematical and statistical reasoning. Discusses various applications of Boolean logic, including the reconstruction and evaluation of (natural language) deductive arguments. Covers inductive-logical reasoning, such as the fundamentals of the probability calculus and its applications to inductive (ampliative) inference. Offers students an opportunity to understand both deductive (e.g., mathematical) and inductive (e.g., statistical) reasoning.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**PHIL 1120. Understanding the Bible. (4 Hours)**

Introduces students to the Old and New Testaments of the Bible in its social, political, and cultural contexts.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**PHIL 1130. Comparative Ethics. (4 Hours)**

Focuses on how traditions imagine the moral life in cross-cultural contexts. Topics may include ideals of human flourishing, notions of virtue and vice, and conceptions of self and community. Offers students an opportunity to learn methods of philosophical analysis and argumentation in cross-cultural contexts.

**Attribute(s):** NUpath Difference/Diversity, NUpath Ethical Reasoning

**PHIL 1133. Selling Spirituality. (4 Hours)**

Emphasizes the ethical consequences of extracting religious practices from racialized communities (including communities associated with Indigenous and Asian traditions). Explores how the marketing of religious practices as "spiritual" contributes to systematic forms of racism and Orientalism. Discusses a wide range of case studies including yoga, mindfulness, and plant psychedelics. Readings include social history, court cases, ethnographies, and media analysis.

**Attribute(s):** NUpath Difference/Diversity, NUpath Ethical Reasoning

**PHIL 1145. Technology and Human Values. (4 Hours)**

Studies philosophy of technology, as well as ethics and modern technology. Considers the relationship between technology and humanity, the social dimensions of technology, and ethical issues raised by emerging technologies. Discusses emerging technologies such as biotechnology, information technology, nanotechnology, and virtual reality.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 1160. Introduction to Economic Justice. (4 Hours)**

Explores questions of economic justice from a philosophical perspective. Examines capitalism, what it is and what its ethical virtues and limitations are; if there are changes or alternatives to capitalism that would make our economic system more just; how much economic inequality we should consider morally acceptable; and in what ways racism and gender discrimination impact the fairness of our economy. Considers these questions by reading works in the history of philosophy while also engaging with contemporary philosophers writing about current challenges to economic justice, such as racism, gender discrimination, and economic inequality.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 1162. Ethics and Philosophy through Sport. (4 Hours)**

Introduces issues in ethics, epistemology, and metaphysics through sports. Each topic consists of a case study from the domain of sports in which an ethical or philosophical issue arises, paired with a classical or contemporary reading on the issue. Thus, this course uses examples from sport that exemplify core philosophical topics that arise as well in domains beyond sport. Studies justice and fairness, ability and disability, conceptual clarity/definition, individual vs. collective welfare, social goods, punishment, animal welfare, and the rationality of group identification. Uses data analysis, prediction models, and rational expectations in sports to illustrate several central issues in epistemology, including the problem of induction, counterfactual reasoning, decision theory, and game theory.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Ethical Reasoning

**PHIL 1165. Moral and Social Problems in Healthcare. (4 Hours)**

Introduces ethical theories and moral principles, and then uses these theories and principles to analyze the moral problems that arise in the medical context. Topics include euthanasia, medical paternalism, informed consent, patient confidentiality, the right to die, the ethics of medical research, abortion, the right to healthcare, distribution of scarce medical resources, and the ethical implications of health maintenance organizations.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 1170. Business, Ethics, and Human Rights. (4 Hours)**

Examines the moral, social, and human rights implications of business for individuals and communities, both globally and domestically. Topics include corporate social responsibility, stakeholder theory, advertising, and gun violence, diversity and racism, CEO activism, affirmative action in the tech sector, the gig economy and employee rights, as well as human rights violations by multinational companies, including sweatshops and environmental harms. Examines the contributions of both big and small businesses to making the world a better place and considers policy that can work to that end.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 1180. Environmental Ethics. (4 Hours)**

Focuses on a current ecological crisis and addresses the values that underlie our concern over this crisis, whether the values at issue are anthropocentric or biocentric. Explores the ethical implications these ecological concerns have for our individual lifestyles, and for our role as members of communities.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 1185. The Ethics of Food. (4 Hours)**

Introduces the ethics of food. Elucidates a wide range of ethical issues associated with food production, processing, distribution, and consumption. Offers students an opportunity to develop skills in ethics and values analysis that can be applied to evaluate food-related practices and policies. Includes topics such as the ethics of different food systems, genetically modified crops, meat eating, hunting, food security, food justice, sustainability, synthetic meat, food advertising, food safety, and foodie culture.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 1195. Research Ethics. (4 Hours)**

Addresses how to engage in scientific, medical, and technological research in an ethically responsible manner. Research is crucial to understanding social, environmental, and health problems, as well as to developing effective responses to them. If the paradigm of responsible research is too restrictive, the benefits of scientific progress and technological innovation can be delayed or unrealized. At the same time, researchers have a responsibility to protect research subjects, to appropriately engage with members of the community, and to avoid behaving in ways that undermine scientific research in the long run. Explores the many ethical dimensions of research, and introduces students to the ethical foundations and controversies that are central to developing appropriate ethical frameworks for engaging in research.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 1220. The Meaning of Death. (4 Hours)**

Explores different philosophical and religious perspectives on death and life after death. Examines some powerful contemporary accounts of personal confrontation with death along with investigations into attitudes toward death in other traditions (for example, Hinduism and Buddhism).

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**PHIL 1260. Apocalypticism in Film. (4 Hours)**

Begins with an investigation of biblical texts that give rise to apocalypticism, definitions of apocalypticism, and an introductory exploration of the various ways in which apocalypticism has manifested itself in Western culture. Examines the diverse and changing presentation of apocalypticism in film and includes titles such as 'The Book of Eli,' 'The Day the Earth Stood Still,' 'Independence Day,' 'The Seventh Seal,' and 'Blade Runner'.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**PHIL 1271. Sex in Judaism, Christianity, and Islam. (4 Hours)**

Explores approaches to gender, social organization of sexuality and gender, sexual ethics, and marriage in Judaism, Christianity, and Islam. Explores various sources within each tradition that serve as normative foundations, contemporary cultural and sociological dynamics that challenge those foundations, and psychological/existential considerations for understanding the general nature of human sexuality. Addresses how these traditions understand gender and gender roles, seek to shape and control interactions between men and women, regulate sexual relations outside of and within marriage, view sexuality education, regard homosexuality, and examine historical and contemporary approaches to marriage, divorce, and parenting. PHIL 1271 and WMNS 1271 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Ethical Reasoning

**PHIL 1275. Hinduism, Buddhism, and Beyond. (4 Hours)**

Examines Hinduism, Jainism, Theravada Buddhism, Mahayana Buddhism, Confucianism, Taoism, and Shinto within South Asia (India) and east Asia (China and Japan). Combines readings in primary source materials (the religious texts of these traditions) with secondary examinations of the historical and doctrinal developments within each tradition and region. This course intends to give students a context in which to examine the ways in which religions develop in interlocking sociocultural and political contexts and to provide a grounding in the lived experiences of these religious traditions.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Interpreting Culture

**PHIL 1280. Islam: Rituals, Traditions, and Debates. (4 Hours)**

Explores Islam through its foundations narrative, rituals, doctrines, and ethical teachings. Presents Islam in terms of its diversity by focusing on a series of key debates in Islamic thought and practice from its early history to the present day in cross-cultural perspectives.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**PHIL 1285. Jewish Religion and Culture. (4 Hours)**

Explores some of the rich variety of Jewish cultural expressions and interpretive traditions, including the Jewish life cycle (birth through death) and the calendar cycle (holidays and daily rituals). Judaism is an ancient, living religious civilization that has evolved continuously over the millennia and around the globe. Offers students an opportunity to become familiar with the major periods of Jewish history and study exemplary formative Jewish texts (from the Bible and its interpreters through rabbinic, legal, and later literatures). Studies the global diversity of Jewish traditions, cultures, and identities, including how Jewish religion and culture have been influenced by the communities in which Jews have lived and live. No prior knowledge of Judaism is necessary or assumed.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**PHIL 1290. Chinese Philosophy and Religion. (4 Hours)**

Surveys the origins and development of the indigenous religious traditions of China, from the oracle bone divinations of the Shang Dynasty to the philosophical and religious traditions of Confucianism, Mohism, Yangism, Daoism, and Legalism. Identifies and elucidates those elements of ancient Chinese thought that have had the most lasting influence on the Chinese ethos and worldview. Studies the foundational texts of ancient China and also examines the relevant practices that helped to define the various traditions of thought. Focuses on how religious and philosophical ideas influenced the larger culture of Chinese life in regard to the arts, medicine, the social order, and government.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Interpreting Culture

**PHIL 1300. Knowledge in a Digital World. (4 Hours)**

Examines the impact that information technologies (such as the internet, search engines, blogs, wikis, and smartphones); information processing techniques (such as big data analysis, machine learning, crowdsourcing, and cryptography); and information policies (such as privacy norms and speech restrictions) have on what we know and how much we know, as individuals and as a society. The digital world can enhance our ability to acquire knowledge by providing us with fast and cheap access to huge amounts of information. However, it can also undermine our cognitive abilities and provide us with inaccurate or misleading information. Studies normative frameworks from epistemology and ethics (such as epistemic value theory, the extended mind hypothesis, and moral rights) to evaluate these technologies and policies.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 1666. The Problem of Evil in Film. (4 Hours)**

Seeks to answer the question, "What is evil?" Uses a variety of film genres to examine the definitions of evil in relation to concepts such as power, sin, hate, greed, envy, murder, neglect, fear, terror, tragedy, and "the Other." Studies the problem of evil from the perspectives of religious studies and philosophy. Examines the various explanations for evil from a variety of Western religious traditions and explores the presentation of ethical dilemmas and moral theory to assess the content of a variety of films. Studies film titles such as The Dark Knight, The Exorcist, Silence of the Lambs, Frankenstein, Life Is Beautiful, Rear Window, Dr. Strangelove, Phone Booth, Crash, Star Wars, and The Wizard of Oz.

**Attribute(s):** NUpath Difference/Diversity, NUpath Ethical Reasoning

**PHIL 1667. Science Fiction and Film: Moral Dilemmas and Ethical Analysis. (4 Hours)**

Explores how science fiction films function as mythical cautionary tales about moral dilemmas of the twentieth and twenty-first centuries and as projections about how these dilemmas may be resolved or continue in the future. Provides a framework for an ethical analysis and examines how themes such as manifest destiny, nationalism, utopia, good vs. evil, war, and concepts of "the Other" are presented in classic and contemporary film. Also shows how science fiction film sometimes reinterprets pre-existing stories from world cultures and world religious traditions, updating earlier moral dilemmas to the contemporary situation.

**Attribute(s):** NUpath Difference/Diversity, NUpath Ethical Reasoning

**PHIL 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHIL 2001. Ethics and Evolutionary Games. (4 Hours)**

Surveys the basic ideas and principles from evolutionary game theory and how they can be applied to philosophical questions about ethical and social norms. Investigates how cooperation evolves and is maintained; where our sense of fairness comes from and how it affects the way we interact with others; why individuals are altruistic; and whether there is a rational basis for our most basic social norms. Basic ethical norms can involve cooperation, altruism, mutual aid, fairness, coordination, and communication. Evolution and game theory, the formal study of social interaction, have recently been applied to these areas in order to better understand how these norms can arise naturally. Prior completion of PHIL 1115, PHIL 1215, or the NU Core requirement for mathematical/analytical thinking level 1 recommended.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 2016. The Philosophy and Ethics of Lying and Deception. (4 Hours)**

Examines lying and other forms of deception in a wide range of modern contexts from advertising to politics, using different theoretical approaches. Offers students an opportunity to use philosophical and economic theories to investigate what lying is, why people lie, when and why it is wrong to lie, how we can learn from other people even though they might be lying, and how social institutions affect—and are affected by—all of this lying. In modern society, we are confronted with lies, spin, fake news, and even “BS” on a daily basis. Since these forms of deception play such a central role in human life, many philosophers—including Plato, Augustine, and Kant—have studied the ontology, ethics, epistemology, economics, and logic of lying and deception.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 2143. Philosophy for Children. (4 Hours)**

Explores big questions in philosophy—how should one conduct oneself, what does it mean to know something, are there object values in an aesthetic domain such as art? Offers students an opportunity to learn methodologies and tools of philosophical inquiry and apply them to works of children’s literature in order to be able to facilitate philosophical discussions in the elementary school classroom. Emphasizes creating a community of inquiry and learning how to devise and communicate different answers to philosophical questions at the elementary level. Students develop lesson plans to help engage young children in philosophical discussion and reflection.

**Attribute(s):** NUpath Creative Express/Innov

**PHIL 2155. Human Rights. (4 Hours)**

Offers students an opportunity to obtain a solid understanding of the political, philosophical, and legal dimensions of human rights as well as an overview of some of the current debates in human rights. Discusses the intellectual history of human rights and explores their philosophical and historical roots. Examines their legal and political dimensions and human rights laws and institutions. Explores in-depth a number of contemporary human rights issues including genocide, women’s rights, children’s rights, refugees, and torture.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 2230. Music and Religion. (4 Hours)**

Explores the relationship between religion, sound, and musical expression using the lenses of gender studies, cultural studies, and performance theory. Emphasizes the interpretive and symbolic understandings of sonic expressions of religiosity, including chanting, mantra use, choir and congregational singing, and speaking in tongues. Seeks to familiarize students with some of the key sonic expressions within the Christian, Islamic, Hindu, and Buddhist traditions; to explore the methods of studying musical and sonic theology; and to analyze these traditions’ own debates about the use of sound and music in religious practice.

**Attribute(s):** NUpath Difference/Diversity, NUpath Integration Experience, NUpath Interpreting Culture, NUpath Writing Intensive

**PHIL 2259. Sex, Gender, and Judaism. (4 Hours)**

Introduces the representation of sex and gender in Jewish culture and religion. Explores varied representations of masculinity and femininity over time and place within Jewish communities; the role of biblical texts in the construction of Western conceptions of gender and sexuality; and how contemporary feminist, queer, and other sexual identities have influenced Jewish practices. Readings draw from a range of primary sources (memoirs, fiction, religious texts, etc.) and critical literature.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**PHIL 2301. Philosophical Problems of Law and Justice. (4 Hours)**

Focuses on general questions about the law: What is the nature and proper scope of the law? How should the law be enforced and are there alternatives to punishment? How can laws be properly interpreted? Examples of legal controversies are related to the theories studied.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 2302. Philosophical Problems of War and Peace. (4 Hours)**

Concentrates on ethical and philosophical issues about war and peace. Focuses on the nature and justification of war, moral questions about tactics in war, ideas for avoiding war, concepts of and strategies for attaining peace, and the morality of relations between nations.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 2303. Social and Political Philosophy. (4 Hours)**

Focuses on basic questions about the nature of the state and the relationship of individuals to the state. What basis is there for individuals to obey the laws of the state? What conditions must a government meet to be legitimate? What justification can be given for democratic forms of government? Also examines what sorts of controls the state should exert over citizens, and what benefits citizens have a right to expect from the state. Includes readings from both classical and contemporary sources. Not open to freshmen students.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 2325. Ancient Philosophy and Political Thought. (4 Hours)**

Examines the philosophers of classical Greece, primarily Socrates, Plato, and Aristotle. These philosophers examined the nature of the material world, of the city, and of the person. The course takes up both the moral and political writings as well as the metaphysical writings. Devotes considerable attention to major works such as Plato's *Republic*. Some time is given to early Greek philosophers, to the Sophists, and to later developments. Requires written analysis of philosophical texts. PHIL 2325 and POLS 2325 are cross-listed.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Ethical Reasoning, NUpath Interpreting Culture, NUpath Writing Intensive

**PHIL 2330. Modern Philosophy. (4 Hours)**

Focuses on philosophical works written during the 17th and 18th centuries and considers their historical, social, and political contexts. Tackles fundamental questions about the nature of reality, self-knowledge, injustice, and the good life through the work of figures like René Descartes, Princess Elisabeth of Bohemia, Margaret Cavendish, John Locke, Jean-Jacques Rousseau, Mary Wollstonecraft, and others. Considers the contributions of women and other underrepresented figures and philosophical developments in the Americas. Requires prior completion of one philosophy course.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions, NUpath Writing Intensive

**PHIL 2390. Cults and Sects. (4 Hours)**

Examines radical religious innovation in the United States from historical, legal, and cultural analytic perspectives. Focuses on minoritized groups such as the Shakers, Peoples Temple, the Nation of Islam, and the Church of Scientology. Offers students an opportunity to acquire critical investigative tools with which to better understand the complexities of lived religion.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**PHIL 2395. Japanese Buddhism. (4 Hours)**

Surveys the major forms of Japanese Buddhism, from the earliest transmission of Buddhism to the maturation of Buddhist thought and practice during the Kamakura and Muromachi periods. Focuses not only on the major schools and figures of each period but also the ways in which Buddhism influenced and shaped Japanese culture. Examines, in particular, the formative influence of Buddhism on Japanese aesthetic sensibilities, samurai culture, and ritual. Focuses thematically on the religious practices that defined each school and how those practices were incorporated into a holistic religious vision.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Ethical Reasoning, NUpath Interpreting Culture, NUpath Writing Intensive

**PHIL 2410. Possession, Sacrifice, and Divination in African Diasporic Religions. (4 Hours)**

Examines religious thought and rituals and its Diaspora in a comparative context. Topics include traditional religions, Islam, Christianity, and Judaism in Africa, and the Diaspora. Emphasizes the transformation of religions practiced in Africa when African captives were forced into the three slave trades affecting the continent of Africa: trans-Saharan, Indian Ocean, and transatlantic.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**PHIL 2492. Indigenous Philosophy. (4 Hours)**

Explores the work of philosophers from a variety of indigenous traditions. Showcases the diverse and rich contributions of these various traditions by engaging with film, poetry, and argumentative prose. Considers topics such as storytelling as philosophical method, locality as an ethical concept, struggles for tribal sovereignty, politics of blood quantum, environmental justice, decolonizing sex and gender, and indigenous futurism. Examines the place of indigenous thought in the modern nation-state and an increasingly global world. Requires prior completion of one philosophy course.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**PHIL 2619. Race and Religion in Film. (4 Hours)**

Explores how relationships between historical and contemporary representations of African Americans, other persons of the African Diaspora, and the continent of Africa have been presented in film in relation to religious themes. Offers an interdisciplinary study in how race and religion are represented in ways that reflect and actively contribute to real-world faith beliefs, experiences, and actions. Critically examines how representations of "the Other" compared to "the chosen" relate to the intersectionality of race, religion, class, national origin, gender, sex, and sexuality. Provides a framework for ethical analysis of how societal institutionalized systems of power influence beliefs about racialized identities and religion.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**PHIL 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHIL 2991. Research Practicum. (2-4 Hours)**

Involves students in collaborative research under the supervision of a faculty member. Offers students an opportunity to learn basic research methods in the discipline. Requires permission of instructor. May be repeated once for up to 4 total credits.

**Attribute(s):** NUpath Integration Experience

**PHIL 3000. Interdisciplinary Methods for Politics, Philosophy, and Economics. (4 Hours)**

Offers students an opportunity to learn to think, research, and write in an interdisciplinary way and bring together the core methods of the three disciplines constituting the PPE major: philosophy, political science, and economics. Examines issues such as housing, environmental justice, and immigration, among others, through an interdisciplinary lens. Students analyze how systemic racism, gender, and other power structures have created asymmetrical distribution of resources, power, and political opportunities and shaped institutions, policies, and outcomes. Includes a service-learning requirement that takes place across the semester. PPE majors should plan to take this course when the majority of the major core courses are complete.

**Prerequisite(s):** PHIL 1160 with a minimum grade of D-

**Attribute(s):** NUpath Integration Experience, NUpath Writing Intensive

**PHIL 3050. Information and Uncertainty. (4 Hours)**

Introduces the foundations of probabilistic inference, information theory, and their uses for drawing conclusions from noisy data. Applications include diagnosing diseases with inconclusive medical tests, locating autonomous vehicles when sensors are imperfect, and how best to make inferences with incomplete or partial information. Central topics include distinguishing deductive and probabilistic inference, philosophical interpretations of probability, fundamental justifications for the rules of probability, and key concepts of information theory. Introduces analytic and mathematical methods of analysis in these cases and contemporary computational (i.e., programming) techniques for implementing and applying theories of information and probabilistic inference.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**PHIL 3065. Bioethics in the Age of Big Data. (4 Hours)**

Explores the ethical issues that arise in the application of emerging applications of AI and Big Data in health and healthcare, especially the ways in which those applications challenge and force us to rethink traditional bioethical frameworks and norms.

**PHIL 3100. The Religious Worlds of Boston: Faith and Devotion in Urban Life. (4 Hours)**

Examines the nature of religion and religious life in Boston, emphasizing the lived experience of the sacred in an urban setting. Offers students an opportunity to develop research methods based in ethnography, the analysis of texts, and the interpretation of material culture. Readings include works in the method and theory of religious studies, the practice of ethnography, and case studies of lived religion, especially those that focus on urban religion. Expects students to engage in fieldwork in Boston, examining the implicit religious dimensions of everyday life and particular religious communities. Assignments include field reports, analysis of the religious landscape of Boston, and a research paper on a designated religious community. Requires prior completion of one introductory-level course in the social sciences or humanities.

**Attribute(s):** NUpath Integration Experience, NUpath Interpreting Culture, NUpath Societies/Institutions

**PHIL 3305. Philosophy of Emotions. (4 Hours)**

Explores central philosophical questions about the emotions. Analyzes what an emotion is and if an emotion is more like a feeling, a belief, or a perception. Discusses if it is irrational to have an emotion that you think that you should not have and what it means for an emotion to be rational in the first place. What does it mean for an emotion to be morally good? How can we know when to trust an emotion? Emphasizes moral psychology and the contributions of neuroscience. Requires prior completion of two philosophy courses.

**Attribute(s):** NUpath Ethical Reasoning

**PHIL 3333. Intercollegiate Ethics Bowl Competition. (1 Hour)**

Offers students an opportunity to participate as members of Northeastern's Ethics or Bioethics Bowl team. Students work with their teammates in preparing for regional and national competitions. Preparation includes devising novel arguments for each competition's cases and weekly meetings with teammates leading up to the competition where students polish their arguments, rebuttals, and questions. Culminates with the option of traveling and participating in a regional and possible national debate competition. May be repeated up to seven times.

**PHIL 3343. Existentialism. (4 Hours)**

Examines existentialist philosophy in its greatest representatives, such as Kierkegaard, Nietzsche, Heidegger, Camus, and Sartre. Focuses on central themes including self-alienation, inauthenticity, authenticity, and existential experiences. Requires prior completion of two philosophy courses.

**PHIL 3360. Scientific Approaches to Philosophy. (4 Hours)**

Explores scientific approaches to traditional philosophical questions and to what extent these classic questions can be addressed by contemporary scientific theories and methods. Surveys recent studies in psychology and neuroscience and their relation to free will, consciousness, and the self. Examines the connections between contemporary physics and philosophical questions about determinism, causality, and the nature of reality. Considers the role of scientific methods in addressing skepticism and the connection to the theory of knowledge. Finally, explores the relevance of the social and biological sciences in answering questions about society, ethics, and morality. Requires prior completion of two philosophy and/or science courses.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 3435. Moral Philosophy. (4 Hours)**

Explores two basic questions: What sorts of things are good or bad? What actions are right or wrong? Covers major philosophical theories about the nature of morality—whether it is relative or absolute, whether it accords or conflicts with self-interest. Such classic theories as utilitarianism and Kant are examined as well as contemporary developments and debates. Requires prior completion of two philosophy courses.

**PHIL 3460. Philosophy and Literature. (4 Hours)**

Provides the student the opportunity to learn to recognize, appreciate, and criticize philosophical themes in literature. Includes readings from acknowledged classics by philosophical authors. Requires prior completion of two philosophy courses.

**PHIL 3500. Sexuality, Gender, and the Law. (4 Hours)**

Examines the legal regulation of gender and sexuality. Investigates concrete legal cases to study the history of constitutional interpretation and the current status of rights for women and sexual minorities. Focuses on important theoretical issues emerging in the writings of diverse feminist and queer legal scholars. Addresses debates over the value of conventional equality approaches in legal doctrine; equality vs. difference perspectives; ways in which legal language constructs gender and sexuality; the incorporation of sexuality and gender in ideologies of law; and the intersections of gender, sexuality, and race in legal doctrine and legal theory. PHIL 3500, POLS 3500, and WMNS 3500 are cross-listed.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**PHIL 3512. Religion, Race, and Politics. (4 Hours)**

Engages the intersections of religion, race, and political power through cultural history, ethnography, and lived religions. Explores the social and cultural categories of our historical and contemporary worlds. Examines how some peoples' histories have been centered, while others' histories have been marginalized. Explores religion as a social category that reproduces existing relations of power while alternatively supporting social revolution and change. Class engagements are centered on theories of power, understandings of difference, and changes in social structures over time, from the colonial period to the present (1500s–2000s).

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**PHIL 3822. Philosophy of Race and Racism. (4 Hours)**

Considers how philosophical tools can help us to understand the issues of race and racism. Controversies about these issues continue to play a crucial role in the public domain. Explores questions such as what is meant by the term race as a biological category; how has the meaning of "race" shifted with time and culture; what is racism (as well as racial injustice and racial discrimination and how should we understand its persistence in areas such as housing and policing); and what steps should be taken to end racism. Examines related phenomena, including xenophobia, ethnocentrism, and imperialism, as well as intersecting forms of oppression, such as sexism. Readings draw on both historical and contemporary sources. Requires two prior courses in philosophy or department permission to register.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**PHIL 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHIL 4050. Artificial Intelligence and Society. (4 Hours)**

Examines the societal impact of artificial intelligence technologies and prominent strategies for aligning these impacts with social and ethical values. Offers multidisciplinary readings to provide conceptual lenses for understanding these technologies in their contexts of use.

**PHIL 4500. Theory of Knowledge. (4 Hours)**

Focuses on questions about the nature and justification of claims to knowledge. Is there genuine knowledge? How do we tell when a belief or theory is sufficiently justified to count as knowledge? Discusses theories such as various forms of rationalism, empiricism, and skepticism. Requires careful reading of works by such influential thinkers as René Descartes, Bertrand Russell, A. J. Ayer, and T. S. Kuhn. Requires prior completion of three philosophy courses.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PHIL 4510. Philosophy of Science. (4 Hours)**

Focuses on the nature of scientific method, scientific theories, and scientific explanations. Examines the central question of why science is thought to provide the most reliable account of the nature of reality. Requires prior completion of three philosophy courses (PHIL 1115 or PHIL 1215 recommended) or permission of instructor.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PHIL 4515. Advanced Deductive Logic. (4 Hours)**

Examines central results of formal deductive logic with a focus on first-order (predicate) logic. Topics include proof systems, decidability, computability, and metatheory.

**Prerequisite(s):** MATH 1215 with a minimum grade of D- or MATH 1365 with a minimum grade of D- or PHIL 1115 with a minimum grade of D-

**PHIL 4516. Advanced Inductive Logic. (4 Hours)**

Examines major views and results in contemporary inductive logic. Focuses on Bayesian epistemology including belief and credence, probability, updating, principles of rationality, theory of confirmation, and decision theory.

**Prerequisite(s):** PHIL 1115 with a minimum grade of D- or MATH 1215 with a minimum grade of D- or MATH 1365 with a minimum grade of D-

**PHIL 4535. Philosophy of Mind. (4 Hours)**

Seeks to show what puzzles and problems result from an honest attempt to answer these questions in a reasonable way: What is the relation between mind and body? Is the mental merely a function of bodily process and behavior, or does it somehow exist "over and above" the material? How are self-knowledge and knowledge of other minds achieved, and what is the relation between words and thoughts? Examines classical sources, such as Descartes and Locke, and contemporary sources, such as Wittgenstein and Putnam. Also seeks to arrive at some answers—however tentative or provisional—to these questions. Constantly challenges students to think and write well about these difficult subjects. Requires prior completion of three philosophy courses or permission of instructor.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PHIL 4550. Philosophy of Economics. (4 Hours)**

Explores the philosophy behind economics. Surveys central ideas in the foundations of economics and formal methods in economics, including utility theory, rational choice theory, game theory, and social choice. Explores applications of economic modeling to institutions, markets, and social interactions. Examines the philosophical significance of economic inquiry, including fact/value distinctions, the ideal of economic rationality, the nature of economic modeling, and the place of economics among the sciences. Requires prior completion of at least three philosophy and/or economics courses.

**Attribute(s):** NUpath Capstone Experience, NUpath Societies/Institutions, NUpath Writing Intensive

**PHIL 4555. Philosophy of Biology. (4 Hours)**

Explores the conceptual foundations of evolution, ecology, and genetics, with special attention to outstanding philosophical questions. Surveys central philosophical and theoretical issues on topics such as the units of selection, the concept and nature of evolutionary fitness, biological functions, causation, biological individuality, the concept of a species, the biology of social behavior, and the explanatory role of natural selection. Also examines the relationship between biology, the physical sciences, and the social sciences. Requires prior completion of three philosophy and/or biology courses.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PHIL 4901. Topics in Philosophy Seminar. (4 Hours)**

Focuses on one specific problem or issue in philosophy. Topics vary, and students may register for the course more than once. Requires prior completion of three philosophy courses. May be repeated without limit.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PHIL 4903. Seminar in Religion. (4 Hours)**

Examines topics including theodicy, cosmogony, contemporary issues in religion, and comparative ethics. Topics vary, and students may register for the course more than once. Requires prior completion of three philosophy or religion courses. May be repeated without limit.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PHIL 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHIL 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**PHIL 4994. Internship. (4 Hours)**

Offers an opportunity for an internship. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**PHIL 5001. Global Justice. (4 Hours)**

Explores the theoretical, political, and philosophical foundations of the obligations that underlie global justice. Theoretical approaches include human rights, human capabilities, cosmopolitanism, particularism, and universalism. Examines nationalism and the particular set of obligations that it generates. Following the theoretical component, the course considers social issues that arise in a global context: (1) the duties to the distant poor, (2) global philanthropy and problems of donee accountability, (3) global health and essential medicines and issues in environmental justice, and (4) issues in international law.

**Attribute(s):** NUpath Capstone Experience, NUpath Ethical Reasoning, NUpath Societies/Institutions, NUpath Writing Intensive

**PHIL 5002. Ethics and Public Policy. (4 Hours)**

Offers students from multiple disciplines an opportunity to obtain training in basic methodology in analytic ethics and political philosophy. Focuses on the intersection of ethical analysis and policy evaluation. Organized around different policy areas, such as energy production and distribution, urban planning, healthcare provision, criminal justice, and artificial intelligence. Engages broad issues involving the relationship between ethics and public policy, as well as the scope and limits of legitimate government authority. Looks at specific policies and policy domains and offers students multiple theoretical frameworks for approaching ethical questions embedded in those policy areas.

**Attribute(s):** NUpath Capstone Experience

**PHIL 5005. Information Ethics. (4 Hours)**

Covers issues of justice and the public good in relation to the creation, collection, storage, analysis, processing, dissemination, and use of information. Discusses theories of justice and human rights, as well as ethical theories such as utilitarianism and principlism. Topics include intellectual and cultural property, freedom of expression, access to information, fair representation, and information privacy. Discusses how to create and use information technologies that promote individual flourishing and the public good while avoiding bias, exploitation, and manipulation.

**Prerequisite(s):** PHIL 1145 with a minimum grade of D- or PHIL 1300 with a minimum grade of D- or IS 1300 with a minimum grade of D- or graduate program admission

**PHIL 5010. AI Ethics. (4 Hours)**

Discusses artificial intelligence and the host of ethical issues it raises: decisions turned over to machine-learning algorithms can be opaque and unfair; autonomous vehicles promise to increase safety but raise challenges for assigning responsibility for accidents; diffusion of AI is likely to transform the labor market in unpredictable ways; and the data that powers machine-learning algorithms raise questions about privacy and security. In order to realize the benefits of AI while responsibly developing and implementing it, it is necessary to identify the ethical issues at stake and work to resolve them. This course takes up the philosophical and ethical questions essential to this project.

**Prerequisite(s):** PHIL 1145 with a minimum grade of D- or PHIL 1300 with a minimum grade of D- or IS 1300 with a minimum grade of D- or graduate program admission

**PHIL 5110. Responsible AI. (4 Hours)**

Covers the design, development, and deployment of artificial intelligence and how it interacts with a wide range of values including fairness, privacy, transparency, autonomy, and well-being. Offers students an opportunity to develop an understanding of the robust legal, regulatory, and ethical landscape of AI applications across domains and sectors to realize the promise of AI while promoting and protecting values, as well as instruction in the tools necessary to responsibly engage with AI.

**PHIL 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Philosophy - CPS (PHL)****PHL 1100. Social and Political Philosophy. (3 Hours)**

Examines theories of social change, social institutions, and major contemporary political theories. Asks general questions, such as what constitutes a good state, what actions are right or wrong, and explores differing answers to those questions. Contrasts Immanuel Kant's view that actions are intrinsically moral to John Stuart Mill's theory that the end result determines the rightness or wrongness of an act. Includes material from social theorists such as Paley, Nietzsche, B. F. Skinner, and Ayer.

**PHL 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHL 2100. Business Ethics. (3 Hours)**

Focuses on basic ethical viewpoints as a foundation and examines specific characteristics of business life through cases and examples. The fact that there is not one universal set of behaviors one considers ethical and no guidelines to follow to determine ethical behavior poses unique challenges to managers today. Yet, managers are daily faced with situations where individual values may conflict with those of teams or organizations. Explores topics such as corporate responsibility and conflict of interest, employee rights, and advertising and information disclosure.

**Attribute(s):** NUpath Ethical Reasoning

**PHL 2120. Ethical Issues in Communication. (3 Hours)**

Examines ethical issues in communication. Discusses how ethical choices affect communication to internal and external audiences, management transparency, strategic ambiguity, and employee privacy.

**Prerequisite(s):** CMN 1100 with a minimum grade of D- or CMN 1103 with a minimum grade of D- or CMN 2210 with a minimum grade of D-

**Attribute(s):** NUpath Ethical Reasoning

**PHL 2130. Ethical Issues in Healthcare. (3 Hours)**

Considers biomedical, clinical, social, and legal issues related to ethical issues and integrates such considerations into ethical decision making. Emphasizes the concepts of do no harm, quality of life, and conflict resolution. Other topics include patients' rights and the protection of their confidentiality, privacy, and personal prerogatives. Explores case studies and readings to assess the presence of ethical considerations.

**Attribute(s):** NUpath Ethical Reasoning

**PHL 2140. Ethical Issues in Science and Engineering. (3 Hours)**

Examines ethical principles and considerations involved in making moral decisions. Analyzes specific examples in medicine, science and engineering through case studies and readings.

**Attribute(s):** NUpath Ethical Reasoning

**PHL 2310. Symbolic Logic. (3 Hours)**

Introduces propositional and first-order quantification logic. Offers students an opportunity to evaluate the status of logical formulas and arguments, to create examples and counterexamples, and to construct both informal and formal proofs.

**Attribute(s):** NUpath Formal/Quant Reasoning

**PHL 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHL 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHL 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**PHL 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Philosophy - CPS Specialty (PHLS)****PHLS 1101. Introduction to Philosophy. (4 Hours)**

Introduces students to philosophy by acquainting them with the theories and arguments of classical and contemporary philosophers and by teaching skills of constructing and analyzing arguments. Emphasizes philosophical inquiry. Topics include the basis of morality, free will vs. determinism, the existence of God, the problem of suffering, and the nature of knowledge.

**PHLS 1145. Technology and Human Values. (4 Hours)**

Examines the changing values of the modern, technologically advanced world. Attempts to increase our understanding of the supposed breach between the literary and scientific cultures, the diverse approaches towards their reconciliation, and the human dimensions of science and technology. Topics include the neutrality of technology with respect to good or evil uses, technology as an instrument for human liberation, and the issue of proper and effective modes of controlling technology in today's world.

## Physical Therapy (PT)

**PT 1000. College: An Introduction. (1 Hour)**

Provides an introduction to the University, college, and health professions to enhance students' understanding of self and the decisions they make academically and socially as members of the University's diverse, multicultural community. Group activities and individual assignments along with active participation in a learning community help students adjust to life on an urban campus, develop a better understanding of the learning process, acquire essential academic skills, and make connections with the faculty and students in the college.

**PT 1880. Introduction to Sports Medicine. (4 Hours)**

Offers an introductory course intended for students interested in sports, coaching, medicine, and exercise. Exposes students to the field of sports medicine. Emphasizes orthopedic anatomy, exercise principles, and a basic introduction to prevention of injury and illness related to athletes. Includes a cadaveric lab and lectures.

**Attribute(s):** NUpath Natural/Designed World

**PT 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PT 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PT 2991. Research in Physical Therapy. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated once.

**PT 3300. Human Gross Anatomy. (3 Hours)**

Covers the structure and function of the human body. Emphasizes the skeletal, muscular, digestive, cardiopulmonary, and peripheral nervous systems. Using a regional and systemic approach, explores the details of the limbs, thorax, abdomen, and pelvic regions of the body. Considers basic abnormalities of structure and function via clinical application of these systems.

**Prerequisite(s):** BIOL 1111 with a minimum grade of D- or BIOL 1113 with a minimum grade of D- or BIOL 2217 with a minimum grade of D-

**Corequisite(s):** PT 3301

**PT 3301. Lab for PT 3300. (1 Hour)**

Offers hands-on exploration of the human body utilizing cadaveric specimens and models. Covers the structure and function of the appendicular and axial skeletal systems of the body through prospected human cadavers and osteology. Emphasizes the skeletal, muscular, digestive, cardiopulmonary, and peripheral nervous systems.

**Prerequisite(s):** BIOL 1112 with a minimum grade of D- or BIOL 1114 with a minimum grade of D- or BIOL 2218 with a minimum grade of D-

**Corequisite(s):** PT 3300

**PT 3400. Human Kinesiology. (4 Hours)**

Studies normal movement through the analysis of muscle and joint function. Introduces fundamental examples of pathokinesiology, aberrant motions, and gait and posture. Emphasizes the analysis of the major joints and regions of the body.

**Prerequisite(s):** BIOL 2217 with a minimum grade of D- or BIOL 1117 with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World

**PT 3500. Motor Control of Human Movement. (4 Hours)**

Covers two broad areas that impact the human movement system: motor control and motor learning. Examines neural, behavioral, and physical mechanisms that contribute to the control of movement in humans. Focuses on motor control in healthy persons, with some discussion of alterations associated with musculoskeletal and neural impairment. Examines factors that influence the learning of new motor skills (motor learning) as a result of practice and/or experience.

**Prerequisite(s):** BIOL 2217 with a minimum grade of D- or BIOL 1117 with a minimum grade of D-

**PT 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PT 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PT 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**PT 4996. Experiential Education Directed Study. (1-4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major. Restricted to those students who are using it to fulfill their experiential education requirement. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**PT 5101. Foundations of Physical Therapy. (3 Hours)**

Designed to provide a basic practical understanding of patient care procedures used in physical therapy practice. Covers body mechanics, therapeutic positioning, patient ambulation, transfer techniques, soft tissue mobilization, and documentation. Offers the learner an opportunity to obtain the information needed to use therapeutic modalities in a variety of clinical settings. Introduces physical therapy students to professional behaviors.

**Corequisite(s):** PT 5102

**PT 5102. Lab for PT 5101. (1 Hour)**

Accompanies PT 5101. Covers topics from the course through various experiments.

**Corequisite(s):** PT 5101

**PT 5111. Professional Development for Bouvé Graduate Co-op. (1 Hour)**

Introduces graduate students to the Bouvé Cooperative Education Program and offers an opportunity to develop job-search and career-management skills. Students perform assessments of their workplace skills, interests, and values and discuss how they impact personal career decisions. Offers students an opportunity to prepare a professional-style résumé, learn proper interviewing techniques, and gain an understanding of the opportunities available to them for co-op. Introduces career paths, choices, and career decision making. Seeks to familiarize students with workplace issues relative to their field of study and to teach them to use myNEU COOL database in the job-search and referral process. Presents and discusses co-op policies, procedures, and expectations of the Bouvé Cooperative Education Program and co-op employers.

**PT 5133. Kinesiology. (3 Hours)**

Studies normal movement through the analysis of muscle and joint function. Introduces fundamental examples of pathokinesiology, aberrant motions, and postures. Emphasizes analysis of the major joints and regions of the body as related to the field of physical therapy, including aspects of gait analysis. Encourages critical thinking and integrates material learned in prior course work, including, but not limited to, anatomy and physiology.

**Attribute(s):** NUpath Natural/Designed World

**PT 5138. Neuroscience. (4 Hours)**

Covers the structure and physiological function of the human nervous system with emphasis on the clinical aspects of motor and somatosensory systems. Studies the anatomy of the brain, brain stem, and spinal cord in specimens and on slides and integrated with the basic physiology of motor and sensory systems. The application of neuroscience to clinical neurological cases is a foundation of this course.

**Prerequisite(s):** (PT 5131 with a minimum grade of C or PT 5131 with a minimum grade of C ) or (PT 6340 with a minimum grade of C ; PT 6341 with a minimum grade of C )

**Corequisite(s):** PT 5139

**PT 5139. Lab for PT 5138. (1 Hour)**

Accompanies PT 5138. Covers topics from the course through various experiments.

**Corequisite(s):** PT 5138

**PT 5140. Pathology. (4 Hours)**

Covers foundational knowledge of pathological processes of major body systems. Addresses general medicine, laboratory medicine, and pathophysiology as related to patient conditions that impact physical therapy management. Case-based discussion allows for integration of pathology and pharmacology content.

**Prerequisite(s):** (PT 5131 with a minimum grade of C or PT 5131 with a minimum grade of C ) or (PT 6340 with a minimum grade of C ; PT 6341 with a minimum grade of C )

**PT 5150. Motor Control, Development, and Learning. (4 Hours)**

Covers three broad areas—motor control, motor development, and motor learning. Examines neural, behavioral, and physical mechanisms that contribute to the control of movement in humans. Focuses on motor control in healthy persons, with some discussion of alterations associated with musculoskeletal and neural impairment. Addresses motor development and maturation from intrauterine life through old age (senescence). Considers the interaction of body-system development and growth on acquisition of and changes in typical skill development. Examines factors that influence the learning of new motor skills (motor learning) as a result of practice.

**Prerequisite(s):** PT 6340 with a minimum grade of C or (PT 5133 with a minimum grade of C ; PT 5138 (may be taken concurrently) with a minimum grade of C )

**Corequisite(s):** PT 5151

**PT 5151. Lab for PT 5150. (1 Hour)**

Offers students an opportunity to apply knowledge gained in PT 5150 to activities designed to illustrate various principles and concepts related to motor control, motor development, and motor learning. Uses a series of guiding questions/activities in each laboratory and analyzes associated literature to offer students an opportunity to apply class concepts to healthy individuals and to those with clinical problems related to motor control, motor development, or motor learning.

**Corequisite(s):** PT 5150

**Attribute(s):** NUpath Analyzing/Using Data

**PT 5160. Psychosocial Aspects of Healthcare. (3 Hours)**

Examines interpersonal relationships among patients, families, health professionals, and society, with reference to the impact of and reaction to illness and disability. Identifies personal and societal beliefs, values, and attitudes that affect the role of people with illness or disabilities in our culture and the healthcare system; how patients' beliefs, values, and experiences affect their expectations and interactions with healthcare professionals; and how beliefs, values, and experiences shape professional development and affect relationships with patients.

**Attribute(s):** NUpath Ethical Reasoning

**PT 5165. Sports Medicine: Managing the Injured Athlete. (4 Hours)**

Offers students an opportunity to obtain in-depth knowledge in sports medicine. Covers taping and bracing procedures and techniques to assess concussions with various current protocols. Exposes students to current common pathologies within the athletic population. Discusses return-to-play criteria for an athlete once an injury has occurred and has subsequently been treated and rehabilitated.

**PT 5170. Motor Control. (3 Hours)**

Focuses on the theories and models of neuromuscular control and learning of human movement. Examines the relationship between theory and practice and how motor function may be altered by a variety of factors.

**Corequisite(s):** PT 5171

**PT 5171. Lab for PT 5170. (1 Hour)**

Accompanies PT 5170. Covers topics from the course through various experiments.

**Corequisite(s):** PT 5170

**PT 5209. Neurological Rehabilitation 1. (4 Hours)**

Covers the foundations of the physical therapy examination, evaluation, and intervention for persons with neurological deficits. Presents examination skills, theoretical bases, and clinical applications of integrated intervention approaches for the patient with a neurological diagnosis. Includes the etiology, pathology, medical management, and physical therapy management of common neurology disorders affecting the adult population. Accompanied by PT 5210.

**Prerequisite(s):** PT 5150 with a minimum grade of C or PT 5150 with a minimum grade of C

**Corequisite(s):** PT 5210

**PT 5210. Lab for PT 5209. (1 Hour)**

Accompanies PT 5209. Covers the foundations of the physical therapy examination, evaluation, and intervention with patients with neurological deficits. Presents clinical procedures for examination skills, evaluation, and clinical applications of integrated intervention approaches for the patient with a neurological diagnosis.

**Corequisite(s):** PT 5209

**PT 5226. Physical Therapy Professional Seminar 2. (2 Hours)**

Continues PT 5135 and builds on concepts introduced in the earlier course. Affords students the opportunity to reflect on issues in experiential education and prepare for future experiential learning.

**PT 5227. Physical Therapy Project 1. (3 Hours)**

Provides students with the opportunity to conduct an independent project under the mentorship of physical therapy faculty in areas such as research, education, clinical practice, administration, or service learning.

**Prerequisite(s):** (PT 5515 with a minimum grade of C or PT 5515 with a minimum grade of C); (PT 5540 with a minimum grade of C or PT 5540 with a minimum grade of C); (PT 6243 with a minimum grade of C or PT 6243 with a minimum grade of C)

**Attribute(s):** NUpath Capstone Experience, NUpath Creative Express/Innov, NUpath Formal/Quant Reasoning, NUpath Writing Intensive

**PT 5229. Physical Therapy Project 2. (2 Hours)**

Provides students with an opportunity to work with individual faculty on scholarship activities to create a scholarly work in partial fulfillment of the requirement for a Doctor of Physical Therapy degree. Allows students to begin or continue their research or education project. Guides students as necessary to enable them to complete their capstone project.

**Prerequisite(s):** PT 5227 with a minimum grade of C or PT 5227 with a minimum grade of C or CAEP 5150 with a minimum grade of C or CAEP 5150 with a minimum grade of C

**Attribute(s):** NUpath Capstone Experience

**PT 5230. Pediatric and Geriatric Aspects of Life Span Management. (3 Hours)**

Incorporates analysis and comparison of methods of physical therapy (PT) management of selected populations across the life span, which includes pediatrics and geriatrics. Focuses on utilizing evidenced-based rationale for clinical decision making within the context of PT examination, evaluation, PT diagnosis, prognosis, and plan of care. Discusses how patient/client management seeks to reflect core professional values, as well as topics of prevention and wellness in these patient populations.

**Prerequisite(s):** (PT 5209 with a minimum grade of C or PT 5209 with a minimum grade of C); (PT 5505 with a minimum grade of C or PT 5505 with a minimum grade of C); (PT 6241 with a minimum grade of C or PT 6241 with a minimum grade of C)

**PT 5321. Applications of Biomechanics in Human Function and Movement. (4 Hours)**

Designed to help students develop an understanding of biomechanical concepts, as they apply to the analysis of human movement and function, through experiential learning. Introduces emerging methodologies and techniques in the field of biomechanics, particularly as they relate to human movement. Course activities require both computational analyses and conceptual understanding. Exposes students to types of data acquisition, reduction, analysis, and interpretations. Includes those factors that identify limitations to the action and measurement of human movement. Offers students an opportunity to integrate knowledge emerging from multiple disciplines, including biomechanics, movement sciences, biology, and physics, as those disciplines apply to functional human movement.

**PT 5410. Functional Human Neuroanatomy. (4 Hours)**

Examines the detailed structure of the human nervous system, linking structure to function at both the clinical and neurobiological level. Offers students an opportunity to obtain a solid functional anatomical foundation for neuroscience. Reviews basic neuroanatomy and then provides a detailed look into the structure of the nuclei within the central nervous system and their connectivity. Examines the role of these structures in motor and sensory function as well as in complex cognitive functions at a physiological and clinical level.

**Prerequisite(s):** ((BIOL 1113 with a minimum grade of D- or BIOL 2217 with a minimum grade of D- or BIOL 1117 with a minimum grade of D- or BIOL 2299 with a minimum grade of D-); (BIOL 3405 with a minimum grade of D- or PSYC 3458 with a minimum grade of D-)) or graduate program admission

**Corequisite(s):** PT 5411

**PT 5411. Lab for PT 5410. (1 Hour)**

Examines the detailed structure of the human nervous system in specimens of the human brain and spinal cord as well as in images of stained sections of these tissues and magnetic resonance images (MRI). The structure of individual nuclei and the main sensory and motor tracts of the nervous system are examined and discussed by students working in small groups. Although focusing on anatomical details, the lab introduces the student to clinical diagnosis of neurological cases.

**Corequisite(s):** PT 5410

**PT 5500. Pharmacology for Physical Therapy. (2 Hours)**

Offers a clinically oriented course covering knowledge of clinical pharmacology in the physical therapy profession. Discusses prescription and over-the-counter drugs and common herbal supplements. Drug classification, pharmacokinetics, pharmacodynamics, mechanism of action, drug interactions, and common side effects are brought into the clinical perspective of patient management. Explores recognition of expected drug effects, side effects, idiosyncratic reactions, and signs of abuse or nonadherence. Along with PT 5140, emphasizes the therapist's proper incorporation of pharmacotherapeutic knowledge into patient assessment, differential diagnosis, and design of treatment regimens.

**Prerequisite(s):** PT 5131 with a minimum grade of C or (PT 6340 with a minimum grade of C ; PT 6341 with a minimum grade of C )

**PT 5503. Cardiovascular and Pulmonary Management. (4 Hours)**

Discusses physical therapy examination evaluation, interventions, and outcome assessment of common cardiac and pulmonary dysfunctions. Discusses etiology and pathology of common cardiac and pulmonary disorders. Uses case-based learning to promote synthesis of the material.

**Prerequisite(s):** (PT 5140 with a minimum grade of C or PT 5140 with a minimum grade of C ) or (PT 6340 with a minimum grade of C ; PT 6341 with a minimum grade of C )

**Corequisite(s):** PT 5504

**PT 5504. Lab for PT 5503. (1 Hour)**

Accompanies PT 5503. Covers topics from the course through various experiments.

**Corequisite(s):** PT 5503

**PT 5505. Musculoskeletal Management 1. (4 Hours)**

Discusses physical therapy examination evaluation, interventions, and outcome assessment of common musculoskeletal dysfunctions. Uses case-based learning to promote synthesis of the material.

**Prerequisite(s):** (PT 5515 with a minimum grade of C or PT 5515 with a minimum grade of C ); (PT 5540 with a minimum grade of C or PT 5540 with a minimum grade of C )

**Corequisite(s):** PT 5506

**PT 5506. Lab for PT 5505. (1 Hour)**

Accompanies PT 5505. Covers topics from the course through various experiments.

**Corequisite(s):** PT 5505

**PT 5515. Integumentary Systems. (2 Hours)**

Applies anatomy, physiology, epidemiology, and pathology to explore the issues of medical, surgical, pharmacological, and psychological and physical therapy management of individuals throughout the life span with integumentary system impairments. Offers learners an opportunity to develop examination skills to derive diagnoses, prognoses, evaluations, and effective physical therapy interventions based on relevant evidence. Includes modalities for wound care and electrophysiological testing and interpretation. Uses case studies to integrate and apply the information obtained through readings, lectures, and lab.

**Prerequisite(s):** (PT 5101 with a minimum grade of C or PT 5101 with a minimum grade of C ); (PT 5102 with a minimum grade of C or PT 5102 with a minimum grade of C )

**Corequisite(s):** PT 5516

**PT 5516. Lab for PT 5515. (1 Hour)**

Accompanies PT 5515. Covers topics from the course through various experiments.

**Corequisite(s):** PT 5515

**PT 5540. Clinical Integration 1: Evidence and Practice. (2 Hours)**

Designed to prepare physical therapy students to integrate previous courses taught in the curriculum to safely manage patients in the acute-care setting, including the intensive-care unit, the critical-care unit, and step-down settings. Uses a combination of lecture, instruction in the simulation center, and standardized patient interactions. Follows the "Guide to Physical Therapy Practice for Evaluation and Intervention" in these settings. Offers students an opportunity to learn to perform an examination; to evaluate examination data to formulate a plan of care; to provide interventions; to determine a discharge plan for individuals in the acute-care environment; and to demonstrate core professional values in classroom, recitation, and standardized patient interactions.

**Prerequisite(s):** (PT 5150 with a minimum grade of C or PT 5150 with a minimum grade of C ); (PT 5500 with a minimum grade of C or PT 5500 with a minimum grade of C ); (PT 5503 with a minimum grade of C or PT 5503 with a minimum grade of C )

**PT 5976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**PT 6000. Leadership, Administration, and Management. (2 Hours)**

Offers students an opportunity to develop the ability to analyze and evaluate changes in the healthcare system, health policy, and the impact on the delivery of services with a focus on physical therapy. Appraises key business and management concepts, including personnel, insurance, finance, marketing, productivity, and financial and legal regulations within the context of ethical practice. Emphasizes and examines leadership concepts in the areas of advocacy, legislation, and the promotion of the profession.

**Prerequisite(s):** (PT 5145 with a minimum grade of C or PT 5145 with a minimum grade of C ); (PT 6243 with a minimum grade of C or PT 6243 with a minimum grade of C )

**PT 6055. Introduction to Sports Performance. (1 Hour)**

Introduces students to injury prevention and covers illnesses related to athletes, management of athletic injury, roles of sports medicine providers, exercise and training principles, and career options in sports for physical therapists. Includes didactic and hands-on training. Offers additional material regarding NU-related DPT coursework and sports residency. This course is designed for Doctor of Physical Therapy students interested in sports medicine, strength and conditioning, and human performance.

**PT 6215. Assistive Technology. (3 Hours)**

Studies theory and current practice in the use of prosthetics, orthotics, and assisted-living devices.

**Prerequisite(s):** (PT 5230 with a minimum grade of C or PT 5230 with a minimum grade of C ); (PT 6221 with a minimum grade of C or PT 6221 with a minimum grade of C ); (PT 6223 with a minimum grade of C or PT 6223 with a minimum grade of C )

**Corequisite(s):** PT 6216

**PT 6216. Lab for PT 6215. (1 Hour)**

Accompanies PT 6215. Covers topics from the course through various experiments.

**Corequisite(s):** PT 6215

**PT 6221. Neurological Rehabilitation 2. (4 Hours)**

Focuses on the physical therapy management of adults with neurological dysfunctions. Concentrates on management of functional activity limitations, participation restrictions, and impairments resulting from neurological disease and/or trauma. Offers students an opportunity to learn about the etiology, pathology, clinical signs, and medical management of adults with neurological disorders; to learn to perform an examination, evaluate the examination data to formulate a plan of care, and provide interventions; and to use evidence-based decision making.

**Prerequisite(s):** (PT 5209 with a minimum grade of C or PT 5209 with a minimum grade of C ); (PT 5210 with a minimum grade of C or PT 5210 with a minimum grade of C )

**Corequisite(s):** PT 6222

**PT 6222. Lab for PT 6221. (1 Hour)**

Accompanies PT 6221. Covers topics from the course through various experiments.

**Corequisite(s):** PT 6221

**PT 6223. Musculoskeletal Management 2. (4 Hours)**

Provides an in-depth analysis of musculoskeletal management. Compares intervention protocols as an integral component of this course. Allows, in the lab component, for practical application of spinal joint mobilization, modalities, ergonomic assessment, functional training, and therapeutic exercise. Uses case-based learning to promote synthesis of the material.

**Prerequisite(s):** (PT 5505 with a minimum grade of C or PT 5505 with a minimum grade of C ); (PT 6241 with a minimum grade of C or PT 6241 with a minimum grade of C )

**Corequisite(s):** PT 6224

**PT 6224. Lab for PT 6223. (1 Hour)**

Accompanies PT 6223. Covers topics from the course through various experiments.

**Corequisite(s):** PT 6223

**PT 6230. Capstone Project: Human Movement and Rehabilitation Sciences. (4 Hours)**

Offers students an opportunity for active engagement to shape the focus of the course and the capstone experience. Encourages production of high-quality written work and professional presentation methods. Students produce a peer-reviewed journal article that includes the methodology, results, limitations, and recommendations for further action based on the outcomes of their projects.

**Prerequisite(s):** PT 7010 with a minimum grade of C ; PT 7020 with a minimum grade of C

**PT 6233. Advanced Physical Therapy Topics in Orthopedics. (2 Hours)**

Provides students with an opportunity to obtain in-depth knowledge in orthopedics and physical therapy. Course topics vary each semester offered. Topics are determined by significant events and changes in the field. This course may be taken more than once, as long as topics are different. May be repeated without limit.

**Prerequisite(s):** PT 5505 with a minimum grade of C or PT 5505 with a minimum grade of C

**PT 6237. Advanced Special Topics in Physical Therapy. (2 Hours)**

Provides students with an opportunity to obtain in-depth knowledge in a specific physical therapy topic area. Course topics vary each semester offered. Topics are determined by significant events and changes in the field. This course may be taken more than once, as long as topics are different.

**Prerequisite(s):** PT 6305 with a minimum grade of C or PT 5505 with a minimum grade of C or PT 5505 with a minimum grade of C

**PT 6241. Screening for Medical Conditions in Physical Therapy Practice. (4 Hours)**

Designed to prepare physical therapy students to recognize the signs and symptoms of medical conditions and adverse drug reactions as they relate to patient examination and to triage appropriately. Emphasizes screening for medical conditions with the goal of recognizing red, yellow, and green flags as they relate to patient care. Stresses medical referral to other healthcare practitioners in an efficient and effective manner.

**Prerequisite(s):** (PT 5515 with a minimum grade of C or PT 5515 with a minimum grade of C ); (PT 5540 with a minimum grade of C or PT 5540 with a minimum grade of C )

**PT 6243. Health Education, Promotion, and Wellness. (3 Hours)**

Covers health promotion, wellness, disease, impairment, functional limitations, disability, and health risks. Addresses the concept of human difference as a construct relative to behavior theories, lifestyle choices, and health and wellness. Offers learners an opportunity to develop an educational health promotion program for individuals as well as community groups, considering the impact of health disparities, epidemiology, learning styles, barriers, and resources. Offers learners an opportunity to explore a potential consultative role to business, schools, government agencies, and other organizations.

**Prerequisite(s):** PT 5160 with a minimum grade of C or PT 5160 with a minimum grade of C

**Corequisite(s):** PT 6245

**Attribute(s):** NUpath Difference/Diversity

**PT 6245. Seminar for PT 6243. (1 Hour)**

Offers hands-on practice to apply course concepts from PT 6243, in particular health promotion programming for community-based groups. Simultaneously, learners intentionally address the needs/interests of community partners. Learners reflect on their service-learning during on-campus and online activities/assignments.

**Prerequisite(s):** PT 5160 with a minimum grade of C

**Corequisite(s):** PT 6243

**PT 6250. Clinical Integration 2: Evidence and Practice. (2 Hours)**

Offers students an opportunity to practice demonstrating core professional values and to learn how to skillfully manage complex patients across the life span and across practice patterns in a variety of clinical settings. Integrates evidence-based content from previous courses in the curriculum.

**PT 6251. Diagnostic Imaging. (3 Hours)**

Designed to integrate diagnostic imaging principles and techniques relevant to physical therapy practice. Reviews commonly used diagnostic imaging techniques and discusses clinical case studies in a case-based online course.

**PT 6305. Musculoskeletal Management I. (4 Hours)**

Studies the theoretical basis and clinical application of examination and intervention of orthopedic dysfunction of the upper quarter and associated spine that are commonly encountered by physical therapists. Uses an evidence-based, problem-solving approach to prioritize and plan patient care, including medical screening and identifying need for referral. Includes selected topics that reflect the evidence-based philosophies of various noted practitioners in the field of orthopedic physical therapy.

**Prerequisite(s):** PT 5150 with a minimum grade of C ; PT 5151 with a minimum grade of C ; PT 6350 with a minimum grade of C

**Corequisite(s):** PT 6306

**PT 6306. Lab for PT 6305. (1 Hour)**

Accompanies PT 6305. Studies the theoretical basis and clinical application of examination, evaluation, diagnosis, prognosis, and interventions of orthopedic dysfunction of the upper quarter and associated spine that are commonly encountered by physical therapists. Uses an evidence-based, problem-solving approach to prioritize and plan patient care, including medical screening and identifying need for referral. Includes selected topics that reflect the evidence-based philosophies of various noted practitioners in the field of orthopedic physical therapy.

**Prerequisite(s):** PT 5150 with a minimum grade of C ; PT 5151 with a minimum grade of C ; PT 6350 with a minimum grade of C

**Corequisite(s):** PT 6305

**PT 6330. Functional Anatomy 1. (2 Hours)**

Covers the normal structure, function, and principles of biomechanics of the human body. Emphasizes the regions of the head, neck, and trunk. Also considers the basic abnormalities of structure and function.

**Corequisite(s):** PT 6331

**PT 6331. Lab for PT 6330. (1 Hour)**

Accompanies PT 6330. Covers the normal structure, function, and principles of biomechanics of the human body through cadaveric exploration, surface anatomy, and analysis of movement. Emphasizes the regions of the head, neck, and trunk.

**Corequisite(s):** PT 6330

**PT 6340. Functional Anatomy 2. (4 Hours)**

Covers the normal structure and function and principles of biomechanics of the human body, including the analysis of human movement. Emphasizes the upper and lower extremities. Considers basic abnormalities of structure and function.

**Prerequisite(s):** PT 6330 with a minimum grade of C ; PT 6331 with a minimum grade of C

**Corequisite(s):** PT 6341

**PT 6341. Lab for PT 6340. (1 Hour)**

Accompanies PT 6340. Covers the normal structure, function, and principles of biomechanics of the human body through cadaveric exploration, surface anatomy, and analysis of movement. Emphasizes the skeletal, muscular, nervous, and cardiovascular systems of the upper and lower extremities.

**Prerequisite(s):** PT 6330 with a minimum grade of C ; PT 6331 with a minimum grade of C

**Corequisite(s):** PT 6340

**PT 6350. Foundations of PT Examination and Therapeutic Activities. (4 Hours)**

Designed to educate the learner on how to apply, interpret, and perform introductory physical therapy tests and measures and therapeutic activity and exercise interventions. The tests and measures are components of the physical therapist examination process and examine human movement; and the introductory therapeutic activities and exercises are those that would be selected for treatment after those specific examination techniques. Provides an introductory framework to the patient/client professional relationship. Emphasizes the development of the learner's affective, psychomotor, and cognitive skills necessary to assure proper patient/client examination and intervention in the clinical environment.

**Prerequisite(s):** (PT 5101 with a minimum grade of C or PT 5101 with a minimum grade of C ); (PT 5102 with a minimum grade of C or PT 5102 with a minimum grade of C )

**Corequisite(s):** PT 6351

**PT 6351. Lab for PT 6350. (1 Hour)**

Accompanies PT 6350. Provides an introductory framework to the patient/client professional relationship.

**Prerequisite(s):** (PT 5101 with a minimum grade of C or PT 5101 with a minimum grade of C ); (PT 5102 with a minimum grade of C or PT 5102 with a minimum grade of C )

**Corequisite(s):** PT 6350

**PT 6405. Musculoskeletal Management II. (4 Hours)**

Studies the theoretical basis and clinical application of examination and intervention of orthopedic dysfunction of the lower quarter and associated spine that are commonly encountered by physical therapists. Uses an evidence-based, problem-solving approach to prioritize and plan patient care, including medical screening and identifying need for referral. Includes selected topics that reflect the evidence-based philosophies of various noted practitioners in the field of orthopedic physical therapy.

**Prerequisite(s):** PT 6305 with a minimum grade of C ; PT 6306 with a minimum grade of C

**Corequisite(s):** PT 6406

**PT 6406. Lab for PT 6405. (1 Hour)**

Accompanies PT 6405. Studies the theoretical basis and clinical application of examination, evaluation, diagnosis, prognosis, and interventions of orthopedic dysfunction of the lower quarter and associated spine that are commonly encountered by physical therapists. Uses an evidence-based, problem-solving approach to prioritize and plan patient care, including medical screening and identifying need for referral. Includes selected topics that reflect the evidence-based philosophies of various noted practitioners in the field of orthopedic physical therapy.

**Prerequisite(s):** PT 6305 with a minimum grade of C ; PT 6306 with a minimum grade of C

**Corequisite(s):** PT 6405

**PT 6420. PT Administration and Management within the U.S. Healthcare System. (4 Hours)**

Provides the foundation of physical therapy administrative management principles required of physical therapists within the U.S. healthcare system. Examines the current and historical practices of the U.S. healthcare system through the lens of physical therapist delivery, including key legislation and policy changes that have impacted physical therapist delivery over time .Comparative evaluation of selected global healthcare systems is undertaken to understand differences. Discusses and applies leadership fundamentals, advocacy skills, and business and management principles to help students develop administrative skills for contemporary physical therapist practice.

**Prerequisite(s):** PT 5160 with a minimum grade of C

**PT 6441. Clinical Education 1. (6 Hours)**

Provides students with opportunities to practice examination, evaluation, and intervention skills previously learned in the classroom and on co-op. Students work under the supervision and guidance of a licensed physical therapist.

**PT 6442. Clinical Education 2. (6 Hours)**

Continues PT 6441. Provides students with additional opportunities to practice examination, evaluation, and intervention skills learned in the classroom and during the previous course. Students are expected to function at a higher level requiring less supervision and guidance from a licensed physical therapist than was needed during their first clinical education experience.

**Prerequisite(s):** PT 6441 with a minimum grade of S

**PT 6450. Clinical Education 3. (8 Hours)**

Offers learners an opportunity to practice examination, evaluation, and intervention skills previously learned in the classroom and on co-op. Learners work under the supervision and guidance of a licensed physical therapist and function as members of the healthcare team providing consultation and educational services to others. Offers learners an opportunity to refine documentation skills, to develop administrative skills, and to supervise support personnel. Requires a written assignment designed to identify areas of practice that need to be strengthened during Clinical Education 1. Learners must have transportation available, since assignment to clinical sites outside of Boston and Massachusetts is likely. Learners are responsible for costs of all transportation, housing, background checks, uniforms, and other requirements of the clinical site.

**Prerequisite(s):** PT 6442 with a minimum grade of S

**PT 6505. Musculoskeletal Management 3. (3 Hours)**

Builds upon content from earlier musculoskeletal management courses to further provide students with the theoretical basis and clinical application of examination and intervention of more complex orthopedic patient presentations for the extremities, head, spine, and pelvic region. Uses an evidence-based, problem-solving approach to prioritize and plan patient care, including medical screening and identifying need for referral. Offers learners an opportunity to integrate selected topics that reflect the philosophies of various noted practitioners in the field of orthopedic physical therapy.

**Prerequisite(s):** (PT 6405 with a minimum grade of C ; PT 6406 with a minimum grade of C )

**Corequisite(s):** PT 6506

**PT 6506. Lab for PT 6505. (1 Hour)**

Accompanies PT 6505. Uses an evidence-based, problem-solving approach to prioritize and plan patient care, including medical screening and identifying need for referral.

**Prerequisite(s):** PT 6405 with a minimum grade of C ; PT 6406 with a minimum grade of C

**Corequisite(s):** PT 6505

**PT 6510. Evidence-Based Practice and Research Design. (3 Hours)**

Offers an overview of the research process and its application in clinical arenas. Emphasizes the role of the health professional as a consumer of research, with concern for the ethical management and treatment of patients and their families. Elements of research design and their implications in clinical settings provide the framework for the analysis of research. Also emphasizes the use of research findings for evidence-based practice. Encourages interdisciplinary approaches.

**PT 6511. Research Methods and Statistics in PT. (2 Hours)**

Offers students an opportunity to learn about statistical concepts that can be applied to the PT capstone project (PT 6512 and PT 6513). Additionally, understanding statistics helps students become adept consumers of studies, a necessary component of clinicians to keep informed of the latest research for their own practice.

**Prerequisite(s):** PT 6510 with a minimum grade of C

**PT 6512. DPT Capstone 1. (1 Hour)**

Offers students an opportunity to work directly with a faculty mentor(s) on scholarship activities to be disseminated (e.g., peer-reviewed journal article, conference poster) in the future. Students are assigned faculty mentor(s). Mentors determine the type of project students conduct for two semesters. Students are responsible for communicating with their mentor(s) throughout the semester and for completing the work that has been assigned by the specified deadlines. Additionally, students are expected to work cooperatively with fellow students assigned to the group to develop their project.

**Prerequisite(s):** PT 6511 with a minimum grade of C

**PT 6513. DPT Capstone 2. (2 Hours)**

Continues PT 6512. Faculty guide students through the completion of their capstone projects. Students are expected to be motivated and self-directed to complete a high-quality project suitable for dissemination.

**Prerequisite(s):** PT 6512 with a minimum grade of C

**PT 6520. Prosthetic Management. (1 Hour)**

Exposes the learner to current physical therapy clinical practices related to prosthetic rehabilitation as collaborative team members in the care for individuals with amputations. Discusses examination and implementation of physical therapy interventions in the management of individuals with an amputation. Uses a problem-solving approach to develop critical thinking skills to manage individuals with a variety of amputations and prosthetics, including an understanding of the bridge to robotics. Emphasizes prosthetics of the lower extremity and mobility impairments.

**Prerequisite(s):** PT 6350 with a minimum grade of C ; PT 6351 with a minimum grade of C

**Corequisite(s):** PT 6521

**PT 6521. Lab for PT 6520. (1 Hour)**

Accompanies PT 6520. Seeks to develop learners' hands-on application of examination and intervention for individuals with prosthetics. Uses a problem-solving approach to develop critical thinking skills and care strategies for individuals with a variety of amputations and prosthetics, including an understanding of the bridge to robotics. Emphasizes prosthetics of the lower extremity and individuals' mobility.

**Prerequisite(s):** PT 6350 with a minimum grade of C ; PT 6351 with a minimum grade of C

**Corequisite(s):** PT 6520

**PT 6550. Pediatric Aspects of Life Span Management. (3 Hours)**

Incorporates analysis and comparison of methods of physical therapy (PT) management of the pediatric population. Pediatric population is inclusive of the child, the child's parents, and/or caregivers. Focuses on utilizing evidenced-based rationale for clinical decision making within the context of PT examination, evaluation, PT diagnosis, prognosis, and plan of care. Patient/client management reflects core professional values. Also discusses topics of prevention and promotion of optimal health and wellness in this patient population.

**Prerequisite(s):** (PT 5209 with a minimum grade of C or PT 5209 with a minimum grade of C ); (PT 5210 with a minimum grade of C or PT 5210 with a minimum grade of C )

**PT 6555. Geriatric Aspects of Life Span Management. (2 Hours)**

Incorporates a comprehensive analysis and comparison of methods of physical therapy (PT) management of the geriatric population. Focuses on utilizing an evidenced-based approach for clinical decision making within the context of PT examination, evaluation, PT diagnosis, prognosis, and plan of care. Patient/client management reflects core professional values. Also discusses topics of prevention and wellness.

**Prerequisite(s):** (PT 5209 with a minimum grade of C or PT 5209 with a minimum grade of C ); (PT 5210 with a minimum grade of C or PT 5210 with a minimum grade of C )

**PT 6600. Special Topics. (2 Hours)**

Offers learners an opportunity to expand upon current evidence-based topics to reflect current advancements in physical therapist practice. Topics are determined by significant events and changes in the field across areas of clinical practice and in line with accreditation and National Physical Therapist Licensure Examination. Focuses on advanced patient management and complex case analysis that involves multiple systems across the life span. Learners use clinical reasoning theory and evidence-based practice to reflect on patient diagnosis and management.

**Prerequisite(s):** PT 6405 with a minimum grade of C ; PT 6406 with a minimum grade of C

**PT 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PT 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated once.

**PT 7001. Core Concepts in Rehabilitation Science and Research. (3 Hours)**

Exposes students to core concepts in rehabilitation science, including theory, experimental design, models of disablement, and knowledge transfer methods. Offers students an opportunity to develop the skills to critically evaluate models and theories used in rehabilitation science in order to apply select models/theories to their own programs of research. Students evaluate research designs and knowledge translation methods relevant to rehabilitation science and apply this information in planning the design, implementation, and dissemination of their own proposed research.

**PT 7005. Experimental Design and Applied Statistics. (4 Hours)**

Offers an introduction and overview to quantitative human subject research methods typical in movement and rehabilitation sciences as well as other fields. Refers to the set of tools used to develop, design, and complete a study to explore answers to questions through empirical approaches. Emphasizes development of research skills, including the ability to define research problems; write hypotheses; apply research designs; organize, analyze, and present data; perform statistical analyses; and draw relevant conclusions. Offers students an opportunity to formulate testable hypotheses, design experiments using principles of good experimental design, model and analyze experimental data, perform appropriate and valid statistical tests, and interpret the data and statistical outcomes.

**PT 7010. Measurement and Analysis of Human Movement and Bioinstrumentation. (4 Hours)**

Offers students an opportunity to learn how to measure kinematics, kinetics, and muscle activity using bioinstrumentation, including 3D motion capture system, force plates, and electromyography, as well as to learn signal conditioning and processing techniques and how to compute physiological variables such as joint angles, joint torques, ground reaction force, center of pressure, and center of mass. Topics include programming skills in LabVIEW and MATLAB. Students use this information to formulate solutions to biomechanical problems.

**PT 7020. Technologies in Movement and Rehabilitation Science. (4 Hours)**

Covers technologies that have relevance to rehabilitation of individuals with disorders of movement. Topics include measurement of human movement, electroencephalography (EEG), functional magnetic resonance imaging (fMRI), electromyography (EMG), virtual reality and gaming, robotics, neuroprosthetics, noninvasive brain stimulation, and peripheral stimulation. Exposes students to a historical perspective on how the technology evolved, applications of the technology, an overview of how the technology works, existing variants, strengths, limitations/gaps, and future directions.

**PT 7030. Interdisciplinary Seminar in Rehabilitation Science. (1 Hour)**

Engages PhD students in discussions and presentations related to human movement and rehabilitation research in order to help them gain important skills related to critiquing and communicating scientific work. Offers students an opportunity to learn how to provide constructive feedback to colleagues about completed works and works in progress, as well as their communications regarding conference presentations and manuscripts from (or for) peer-reviewed archival journals. Works reviewed include works by students and by world-renowned leaders in the field. Presentations include students, as well as internationally established researchers. May be repeated five times for a maximum of two semester hours.

**PT 7990. Thesis. (4 Hours)**

Offers analytical, research, and/or experimental work conducted under the auspices of the department.

**Prerequisite(s):** PT 7995 with a minimum grade of C-

**PT 7995. Master's Project. (4 Hours)**

Offers analytical and/or experimental work leading to a written report and a final short presentation by the end of the semester.

**PT 8984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated up to four times.

**PT 8986. Research. (0 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**PT 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of program requirements for PhD candidacy.

**PT 9990. Dissertation Term 1. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** PT 9000 with a minimum grade of S

**PT 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** PT 9990 with a minimum grade of S

**PT 9996. Dissertation Continuation. (0 Hours)**

Offers continued dissertation work conducted under the supervision of a departmental faculty member. May be repeated up to five times.

**Prerequisite(s):** PT 9991 with a minimum grade of S or Dissertation Check with a score of REQ

**Physical Therapy - CPS (PTH)****PTH 6101. Medical Screening and Nutrition for Physical Therapists. (5 Hours)**

Offers students an opportunity to obtain the knowledge and skills to screen patients for non-neuromusculoskeletal conditions, interpret clinical findings, and make sound clinical judgments that include providing appropriate referral when beyond the scope of physical therapy practice. Emphasizes diagnostics theory and process skills for a physical therapist to perform a complete and thorough history and relevant regional physical examination. Examines the fundamental role of nutrition in promoting health, focusing on the physiological functions of energy-providing nutrients in the body and their interrelationships. Emphasizes clinical applications for the treatment of weight disorders, various medical disorders, and eating disorders. Addresses nutritional requirements needed to maintain good health and promote healing and rehabilitation.

**PTH 6110. Diagnostic Imaging. (4 Hours)**

Introduces the practicing physical therapist to clinical interpretation of various medical imaging techniques, including plain film radiography, magnetic resonance imaging, and computerized tomography. Emphasizes developing familiarity with the visual appearance of various image modalities, recognition and appreciation of common views employed, assessment of normal and abnormal anatomy, and avoidance of common pitfalls in clinical interpretation within the scope of physical therapy practice.

**PTH 6130. Pharmacology. (3 Hours)**

Covers advanced concepts of pharmacologic management of patients/clients and the interrelationship of pharmacologic management with physical therapy interventions. This includes the physiological processes involved in pharmacodynamics as well as pharmacokinetics with nutrition, absorption, distribution, metabolism, and excretion. Offers students an opportunity to learn how to identify those drugs commonly taken by physical therapy patients and their side effects.

**PTH 6140. Motor Control. (4 Hours)**

Examines advanced topics in motor control and learning. Involves the study of mechanisms underlying the production, control, and rehabilitation of movement control and motor learning. The application of current research to clinical practice across a variety of settings is a vital component of this course. Discusses the behavioral, neural, cognitive, and physical components of motor control and learning, emphasizing the integration of these with physical therapy practice.

**PTH 6200. Research Methods and Statistical Analysis. (5 Hours)**

Presents a computer-oriented introduction to statistical methods with applications in life science. Incorporates descriptive statistics, correlation, probability and regression, and the fundamentals of statistical inference. Discusses the relevance of research and statistical analysis in determining the evidence for the effectiveness of physical therapy.

**PTH 6430. Educational Strategies for Effective Healthcare Delivery. (4 Hours)**

Explores the diverse and growing teaching expectations and opportunities for physical therapists, including the roles of educator with students, patients/clients, family members, and in the community, with an emphasis on cultural sensitivity. The role of physical therapist as educator requires an understanding of educational theory and pedagogy in various settings, from one-on-one sessions with a patient/client, to classroom situations, to public speaking in front of large and diverse crowds.

**PTH 6480. Evidence-Based Exercise for the Older Adult. (4 Hours)**

Seeks to supply the clinician with the most current and pertinent scientific evidence regarding the role of exercise in older adults. Offers students an opportunity to learn best practices to create an exercise prescription. Employs lectures, discussion boards, and case-study analysis to investigate the cardiopulmonary, musculoskeletal, integumentary, and neuromuscular systems involved in health of older adults. Offers students an opportunity to design exercise prescriptions for special populations, including those individuals with osteoporosis, diabetes, arthritis, and cardiopulmonary disease.

**PTH 6563. Evidence-Based Examination and Outcomes for Lumbar Spine and Sacroiliac Joint. (4 Hours)**

Reviews the anatomy and biomechanics of the lumbar spine and sacroiliac joint as it relates to musculoskeletal dysfunction. Presents an update on current medical and surgical interventions. Offers students an opportunity to use group case studies to improve their evidence-informed clinical decision making regarding the examination of the lumbar spine and sacroiliac joint. Analyzes the most current, pertinent scientific evidence and information regarding the rehabilitation of the lumbar spine and sacroiliac joint to include manipulation, imaging, and pharmacology.

**Prerequisite(s):** PTH 6560 with a minimum grade of C- or PTH 6100 with a minimum grade of C- or PTH 6101 with a minimum grade of C-

**PTH 6564. Evidence-Based Examination and Outcomes for Lower Extremity: Hip, Knee, Foot, and Ankle. (4 Hours)**

Reviews the anatomy and biomechanics of the hip, knee, ankle, and foot as it relates to musculoskeletal dysfunction. Offers students an opportunity to use case studies to gain advanced understanding of normal and abnormal gait as it relates to orthopedic dysfunction and to learn interventions to address faulty biomechanics. Seeks to provide clinicians with the most relevant information regarding evidence-informed rehabilitation for lower-extremity examination and treatment techniques.

**Prerequisite(s):** PTH 6560 with a minimum grade of C- or PTH 6100 with a minimum grade of C- or PTH 6101 with a minimum grade of C-

**PTH 6900. Comprehensive Case Analysis. (4 Hours)**

Offers students an opportunity to write a comprehensive and publishable case report, refine it, and analyze it with integration of the components of the patient/client management model, the processes of clinical decision making, and the effective and efficient use of resources. Cases include patients/clients from one of the four categories of conditions that make up the preferred practice patterns in the Guide to Physical Therapist Practice. This case includes information from all courses taken as part of the Doctorate in Physical Therapy and serves as a capstone for the program.

**Prerequisite(s):** PTH 6100 with a minimum grade of C- or PTH 6101 with a minimum grade of C-

**PTH 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PTH 6983. Topics in Physical Therapy. (4 Hours)**

Provides students with an opportunity to study a specific area of interest that is not an elective already listed by completing a related course for credit as an elective in the DPT program. Requires the student to have the permission of the instructor as well as the director of the transitional DPT Program prior to taking the course.

**Physician Assistant (PA)****PA 6200. Anatomy and Physiology 1. (3 Hours)**

Emphasizes the structure and function of the human body including cells, tissues, and organs. Highlights interrelationships among systems and regulation of physiological functions involved in maintaining homeostasis. Focuses on features of clinical importance. Covers musculoskeletal, neurologic, cardiovascular, respiratory, gastrointestinal, endocrine, immunologic, and renal systems. Requires cadaver laboratory sessions. This course is the first in a two-course sequence.

**PA 6201. Anatomy and Physiology 2. (3 Hours)**

Emphasizes the structure and function of the human body including cells, tissues, and organs. Highlights interrelationships among systems and regulation of physiological functions involved in maintaining homeostasis. Focuses on features of clinical importance. Covers musculoskeletal, neurologic, cardiovascular, respiratory, gastrointestinal, endocrine, immunologic, and renal systems. Requires cadaver laboratory sessions. This is the second of a two-course sequence.

**Prerequisite(s):** PA 6200 with a minimum grade of C

**PA 6203. Physical Diagnosis and Patient Evaluation 1. (3 Hours)**

Presents the techniques for eliciting an accurate history, performing an appropriate physical examination, making case presentations, and documenting patient information. Includes issues such as effective communication, confidentiality, cultural competence, and dealing with patients who are terminally ill or disabled. Emphasizes skill development. Students participate in all aspects of the clinical encounter.

**PA 6204. Physical Diagnosis and Patient Evaluation 2. (3 Hours)**

Presents the techniques for eliciting an accurate history, performing an appropriate physical examination, making case presentations, and documenting patients' information. Includes issues such as effective communication, confidentiality, cultural competence, and dealing with patients who are terminally ill or disabled. Emphasizes the correlation of pertinent physical findings with their respective clinical conditions. Students participate in all aspects of the clinical encounter.

**Prerequisite(s):** PA 6203 with a minimum grade of C

**PA 6205. Pharmacology 1. (2 Hours)**

Examines the classification, mechanisms of action, and use of a broad spectrum of therapeutic agents. Focuses on dose response, side effects, adverse reactions, and the role of patient concordance in medication effectiveness.

**PA 6206. Pharmacology 2. (2 Hours)**

Continues PA 6205. Examines the classification, mechanisms of action, and use of a broad spectrum of therapeutic agents. Focuses on dose response, side effects, adverse reactions, and the role of patient concordance in medication effectiveness.

**Prerequisite(s):** PA 6205 with a minimum grade of C

**PA 6207. Clinical Laboratory and Diagnostic Methods. (4 Hours)**

Covers a variety of diagnostic and therapeutic evaluations including clinical laboratory methods, radiologic studies, and electrocardiography. Includes basic principles of diagnostic and therapeutic patient evaluation, radiology, indications and interpretation of clinical laboratory studies, demonstration and practice of various diagnostic methods, and electrocardiography theory and interpretation.

**PA 6208. Professional Issues for Physician Assistants. (2 Hours)**

Offers students the opportunity to understand their professional environment, community resources, legal parameters, and ethical situations they may face. Also addresses interpersonal dynamics in working with physicians and other healthcare providers. Some material is covered in problem-based learning sessions.

**PA 6209. Clinical Laboratory and Diagnostic Methods 1. (3 Hours)**

Covers a variety of diagnostic and therapeutic evaluations including clinical laboratory methods of hematology, transfusion medicine, clinical chemistry, urinalysis and body fluids, radiologic studies inclusive of chest x-ray, and introduction to electrocardiography. Includes basic principles of diagnostic and therapeutic patient evaluation, radiology, indications and interpretation of clinical laboratory studies, demonstration and practice of various diagnostic methods, and electrocardiography theory and interpretation.

**PA 6210. Clinical Laboratory and Diagnostic Methods 2. (1 Hour)**

Covers a variety of diagnostic and therapeutic evaluations including hematology; microbiology; general chemistry and serology; radiologic studies including CT, MRI, and ultrasound; and advanced electrocardiography. Includes principles of diagnostic and therapeutic patient evaluation, radiology, indications and interpretation of clinical laboratory studies, demonstration and practice of various diagnostic methods, and electrocardiography theory and interpretation.

**PA 6311. Principles of Medicine 1. (4 Hours)**

Presents a systems approach to the principles of disease processes and includes such topics as physiology, pathophysiology, the natural history of disease, diagnostic procedures, and therapeutic measures. This course is the first of a three-semester series covering core medical concepts and knowledge grounded in scientific principles and evidence-based medicine on the diseases and conditions commonly encountered in clinical practice.

**PA 6312. Principles of Medicine 2. (4 Hours)**

Continues PA 6311. Presents a systems approach to the principles of disease processes and includes such topics as physiology, pathophysiology, the natural history of disease, diagnostic procedures, and therapeutics measures. This course is the second of a three-semester series covering core medical concepts and knowledge grounded in scientific principles and evidence-based medicine on the diseases and conditions commonly encountered in clinical practice.

**Prerequisite(s):** PA 6311 with a minimum grade of C

**PA 6313. Principles of Medicine 3. (4 Hours)**

Continues PA 6312. Presents a systems approach to the principles of disease processes and includes such topics as physiology, pathophysiology, the natural history of disease, diagnostic procedures, and therapeutics measures. This course is the third of a three-semester series covering core medical concepts and knowledge grounded in scientific principles and evidence-based medicine on the diseases and conditions commonly encountered in clinical practice.

**Prerequisite(s):** PA 6312 with a minimum grade of C

**PA 6320. Principles of Obstetrics and Gynecology. (2 Hours)**

Focuses on the management of women and fetuses from prepregnancy to term as, during much of that time, care is provided to both patients simultaneously. Gynecology attends to women's reproductive issues from prepuberty through senescence. Uses a variety of presentations, clinical case scenarios, and related readings as the basis for students' learning and development of critical thinking skills related to assessment and management of a woman's health. Students may be expected to read, discuss, acquire, and briefly write about women's health issues.

**PA 6321. Principles of Surgery. (2 Hours)**

Offers students an opportunity to explore the surgical environment, approach to the surgical patient, and management of surgical conditions with an emphasis on clinical presentation, operative and nonoperative intervention, and perioperative management. Students participate in clinical skills sessions on a variety of surgical techniques including suturing, knot tying, sterile technique, and other minor surgical procedures.

**PA 6322. Principles of Orthopedics. (2 Hours)**

Discusses common orthopedic problems, including those of the hand, knee, shoulder, and back. Examines special problems of acute trauma and managing uncomplicated orthopedic cases. Also considers such topics as how to complete an adequate patient medical history and perform a physical examination of an orthopedic patient.

**PA 6323. Clinical Neurology. (2 Hours)**

Presents the clinical application of neuroanatomy and neurophysiology. Offers the opportunity to develop an understanding of the nervous system's normal functioning as well as a clinical approach to assessing and managing nervous system disorders and disease states, and their effects on patients and their families.

**PA 6324. Principles of Pediatrics. (2 Hours)**

Presents the physiological and psychological fundamentals of child development. Focuses on the major common pediatric illnesses, including their signs, symptoms, and treatment regimens; various immunizations and medications used in pediatrics and their indication and dosage in relation to specific disorders; and management of pediatric emergencies.

**PA 6325. Principles of Psychiatry. (2 Hours)**

Provides an opportunity to understand how to work with patients and families exhibiting psychiatric problems. Includes such topics as psychological growth and development, psychiatric diagnoses, and the effect of social milieu on behavior, the psychological bases of drug and alcohol abuse, the dynamics of psychosomatic problems, the role of culture in self-concepts, and family attitudes toward mental illness as well as appropriate psychotropic medications.

**PA 6326. Aspects of Primary Care. (4 Hours)**

Studies approaches to and management of the patient in a primary care setting. Discusses specific diseases and medical conditions common to primary care, including HIV/AIDS. Considers psychosocial aspects of disease as well as aspects of prevention.

**PA 6327. Emergency Medicine and Critical Care. (2 Hours)**

Presents the principles of life-support techniques. Focuses on the initial management of acute medical and traumatic conditions in hospital and prehospital situations. Instructs students in basic cardiopulmonary resuscitation techniques including BLS and ACLS. Includes such topics as airway management, hemodynamic monitoring and management, dysrhythmia recognition and treatment, cardiac arrest, hypovolemic states and management, invasive procedures, multiorgan system failure, nutritional support, and metabolic management of the ICU patient.

**PA 6328. Aging and Rehabilitation Medicine. (2 Hours)**

Studies techniques of effective planning and decision making for patients with significant acute and chronic problems. Discusses the purposes, techniques, and potential of rehabilitation medicine. Also focuses on biological changes of aging and appropriate theories of management.

**PA 6329. Healthcare Delivery. (2 Hours)**

Explores the principal components of the healthcare delivery system, emphasizing its social, political, and economic evolution and development. Discusses trends and their implications.

**PA 6330. Research Design. (2 Hours)**

Considers research methods and designs used in varied professional settings. Emphasizes development of research techniques, including the ability to define research problems; write hypotheses; review and interpret literature; apply research designs; organize, analyze, and present data; and draw relevant conclusions.

**PA 6400. Applied Clinical Study in Medicine. (5 Hours)**

Offers supervised clinical practice experience that is designed to foster students' growth regarding general medical knowledge and clinical reasoning skills. Students may have the opportunity to review historical information, interview patients, perform physical exams, order and interpret studies, perform procedures, present assessments, develop differentials, educate patients, coordinate interdisciplinary communication, document encounters, develop professionalism skills, and improve the ability to triage and manage tasks efficiently.

**PA 6401. Applied Clinical Study in Ambulatory Medicine. (5 Hours)**

Offers supervised clinical practice experience. Allows students to further hone their content knowledge and clinical skills either in the area of primary care or in a selected subspecialty area of medicine. Offers students an opportunity to develop skills related to both the initial assessment, as well as the ongoing management of patients with established diagnoses, while working to develop their clinical reasoning skills given initial presentations. Emphasizes assessing and managing both acute and chronic medical problems.

**PA 6402. Applied Clinical Study in Family Practice. (5 Hours)**

Offers supervised clinical practice experience. Offers students an opportunity to evaluate and treat patients while emphasizing the patient as an individual and family member. Clinical rotation experience may include exposure to preventative medicine, patient education, integration of community services, and medical diagnosis and management for both acute and chronic conditions.

**PA 6403. Applied Clinical Study in Emergency Medicine. (5 Hours)**

Offers supervised clinical practice experience. Offers students an opportunity to gain experience triaging, evaluating, and managing patients in an emergency medicine setting. Clinical skills honed may include the ability to diagnose and manage patients who present with urgent and emergent complaints, ranging from acute illnesses and traumatic injuries to life-threatening issues.

**PA 6404. Applied Clinical Study in Women's Health. (5 Hours)**

Offers supervised clinical practice experience. Offers students exposure to clinical medicine as it relates to typical women's health issues. May include common gynecologic disorders, obstetrical complaints, and/or family planning.

**PA 6405. Applied Clinical Study in Pediatrics. (5 Hours)**

Offers supervised clinical practice experience. Offers students an opportunity to manage care of pediatric patients. Common components of this rotation may include exposure to both well child and urgent care visits, offering students an opportunity to develop interview and physical examination skills with children of all ages.

**PA 6406. Applied Clinical Study in Surgery. (5 Hours)**

Offers supervised clinical practice experience. Designed to allow students to gain experience in a surgical setting. Experiences may include preoperative, intraoperative, as well as postoperative patient care. Offers students an opportunity to hone their procedural and assessment skills, distinguish between surgical vs. nonsurgical presentations, and differentiate acute from elective complaints.

**PA 6407. Applied Clinical Study in Mental Health. (5 Hours)**

Offers supervised clinical practice experience. Exposes students to a variety of behavioral medicine patient care experiences. Emphasizes recognizing various types of mental health disorders that may require referral to a specialist and managing problems that can be handled by the nonspecialist. Offers students an opportunity to further their understanding of effective patient interactions and the mental health components of health, disease, and disability.

**PA 6408. Applied Clinical Study Elective. (5 Hours)**

Offers supervised clinical practice experience. Exposes students to a medical, surgical, or subspecialty of either field for further study. Offers students an opportunity to hone their ability to recognize and treat conditions within these fields of medicine to foster utilization or support of related specialists. Select students may participate in an elective that focuses on global health or on a clinical support role, such as administration, leadership, public health, or technology as it relates to healthcare.

**PA 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Physics (PHYS)****PHYS 1000. Physics at Northeastern. (1 Hour)**

Intended for freshmen in the College of Science. Introduces freshmen to the liberal arts in general; familiarizes them with their major; helps them develop the academic skills necessary to succeed (analytical ability and critical thinking); provides grounding in the culture and values of the University community; and helps them develop interpersonal skills—in short, familiarizes students with all skills needed to become a successful university student.

**PHYS 1111. Introduction to Astronomy. (4 Hours)**

Introduces modern astronomical ideas. Topics include an introduction to the cosmos, Earth and its relation to the universe, our solar system (planets, moons, asteroids, and comets), the sun and how it works, stars and their classification, and the life and death of stars. Introduces various tools of the astronomer (the nature of light and radiation, telescopes, the types of spectra, and what they tell us).

**Attribute(s):** NUpath Natural/Designed World

**PHYS 1115. Life in the Universe. (4 Hours)**

Explores the possibility of life in the universe from the astronomy, geology, biology, and chemistry point of view, emphasizing the recent astronomical discoveries of planets outside the solar system. Invites students to consider how planetary evolution affects life or the potential habitability of exoplanets. Analyzes environmental limits or “extremes” under which life can survive and what life might look like on another world. Guides the student on a quest to identify habitable—or even inhabited—worlds through the data of the most recent discoveries and observations.

**Attribute(s):** NUpath Natural/Designed World

**PHYS 1122. Modern Science: A Voyage into Matter, Life, and Mind. (4 Hours)**

Offers an intellectual voyage into matter, life, and mind—the three pillars of modern science. It is a mosaic of different themes that offer a concise overview of science’s greatest minds, ideas, questions, discoveries, theories, and methods while placing all of them within their historical contexts. Emphasizes the profound scientific revolutions of the 20th century—quantum mechanics, biogenetics, and artificial intelligence—that unlocked the secrets of the atom, unraveled the molecule of life, and created the electronic computer. Recognizes significant trends across a wide range of subjects, including medicine, biotechnology, computing and communicating, artificial intelligence and artificial life, and robotics. Discusses the synergism of science, technology, and business on future scientific development.

**Attribute(s):** NUpath Natural/Designed World

**PHYS 1125. Introduction to Network Science: From the Human Cell to Facebook. (4 Hours)**

Introduces network science as a way to understand complex patterns of connections and relationships in increasingly complex social, infrastructure, transportation, information, and biological networks, as well as business and consumer networks. Describes basic conceptual and computational tools to model networks and discusses applications of those tools through a wide range of examples from the World Wide Web to protein and gene networks to massive social networks such as Twitter and Facebook. Discusses both network structures and dynamical phenomena on networks, such as spreading of information, rumors, gossip, and epidemics.

**Attribute(s):** NUpath Natural/Designed World, NUpath Societies/Institutions

**PHYS 1130. Computing, Data, and Science. (4 Hours)**

Introduces how to deal with data and computation problems through the use of computer languages commonly used in the sciences. Focuses on manipulating data, but symbolic calculations are also covered. Intended for science majors during the first summer, when such a course can act as a foundation for later work.

**Attribute(s):** NUpath Analyzing/Using Data

**PHYS 1132. Energy, Environment, and Society. (4 Hours)**

Seeks to provide nonscience students with a practical knowledge of our present use of the Earth's energy resources and the environmental consequences. Topics include fossil fuels for transportation and electrical power, global warming, nuclear energy, solar energy, wind power, biomass, electric and hybrid vehicles, and air pollution. No previous knowledge of physics is assumed; nevertheless, because of the nature of the subject, a significant part of the course includes simple quantitative reasoning.

**Attribute(s):** NUpath Natural/Designed World, NUpath Societies/Institutions

**PHYS 1141. General Physics. (4 Hours)**

Covers mechanics, fluids, and vibrations and waves. Emphasizes the application of physics to a variety of problems in structural engineering. Mechanics topics include one-dimensional motion, forces, vectors, Newton's laws, equilibrium, work, energy, and power. Fluids topics include density, pressure, buoyancy, and fluids in motion. Vibrations and waves topics include mechanical vibrations and sound. Requires knowledge of algebra.

**Attribute(s):** NUpath Natural/Designed World

**PHYS 1145. Physics for Life Sciences 1. (4 Hours)**

Covers mechanics, fluids, and temperature and kinetic theory. The application of physics to a variety of problems in the life and health sciences is emphasized. Mechanics topics include one-dimensional motion, forces, vectors, Newton's laws, equilibrium, work, energy, and power. Fluids topics include density, pressure, buoyancy, fluids in motion, viscosity, and surface tension. Temperature and kinetic theory topics include temperature, thermal equilibrium, gas laws, ideal gas law, kinetic theory, vapor pressure, and diffusion. A laboratory is included.

**Corequisite(s):** PHYS 1146

**Attribute(s):** NUpath Natural/Designed World

**PHYS 1146. Lab for PHYS 1145. (1 Hour)**

Accompanies PHYS 1145. Covers topics from the course through various experiments.

**Corequisite(s):** PHYS 1145

**Attribute(s):** NUpath Analyzing/Using Data

**PHYS 1147. Physics for Life Sciences 2. (4 Hours)**

Continues PHYS 1145. Covers heat, electricity, vibrations and waves, sound, geometrical optics, and nuclear physics and radioactivity. The application of physics to a variety of problems in the life and health sciences is emphasized. Electricity topics include electrostatics, capacitance, resistivity, direct-current circuits, and RC circuits. Vibrations and waves topics include simple harmonic motion and wave motion. Sound topics include wave characteristics, the ear, Doppler effect, shock waves, and ultrasound. Optics topics include reflection, mirrors, refraction, total internal reflection, fiber optics, lenses, the eye, telescopes, and microscopes. Nuclear physics and radioactivity topics include atomic nucleus, radioactivity, half-life, radioactive dating, detectors, nuclear reaction, fission, fusion, radiation damage, radiation therapy, PET, and MRI. A laboratory is included.

**Prerequisite(s):** PHYS 1145 with a minimum grade of D- or PHYS 1149 with a minimum grade of D- or PHYS 1151 with a minimum grade of D- or PHYS 1161 with a minimum grade of D- or PHYS 1171 with a minimum grade of D-

**Corequisite(s):** PHYS 1148

**Attribute(s):** NUpath Natural/Designed World

**PHYS 1148. Lab for PHYS 1147. (1 Hour)**

Accompanies PHYS 1147. Covers topics from the course through various experiments.

**Corequisite(s):** PHYS 1147

**Attribute(s):** NUpath Analyzing/Using Data

**PHYS 1149. Physics for Pharmacy. (4 Hours)**

Offers an integrated lecture and laboratory course for pharmacy students.

**Corequisite(s):** PHYS 1150

**Attribute(s):** NUpath Natural/Designed World

**PHYS 1150. Lab for PHYS 1149. (1 Hour)**

Accompanies PHYS 1149. Covers topics from the course through various experiments.

**Corequisite(s):** PHYS 1149

**Attribute(s):** NUpath Analyzing/Using Data

**PHYS 1151. Physics for Engineering 1. (3 Hours)**

Covers calculus-based physics. Offers the first semester of a two-semester integrated lecture and laboratory sequence intended primarily for engineering students. Covers Newtonian mechanics and fluids. Stresses the balance between understanding the basic concepts and solving specific problems. Includes topics such as one-dimensional and three-dimensional motion, Newton's laws, dynamics friction, drag, work, energy and power, momentum and collisions, rotational dynamics, forces, torque and static equilibrium, pressure, fluids, and gravity.

**Prerequisite(s):** MATH 1241 with a minimum grade of D- or MATH 1251 with a minimum grade of D- or MATH 1340 (may be taken concurrently) with a minimum grade of D- or MATH 1341 (may be taken concurrently) with a minimum grade of D- or MATH 1342 (may be taken concurrently) with a minimum grade of D- or MATH 2321 (may be taken concurrently) with a minimum grade of D-

**Corequisite(s):** PHYS 1153

**Attribute(s):** NUpath Natural/Designed World

**PHYS 1152. Lab for PHYS 1151. (1 Hour)**

Accompanies PHYS 1151. Covers topics from the course through various experiments. Requires concurrent registration in PHYS 1151 and PHYS 1153.

**Attribute(s):** NUpath Analyzing/Using Data

**PHYS 1153. Interactive Learning Seminar for PHYS 1151. (1 Hour)**

Offers interactive problem solving for PHYS 1151. Emphasizes organized approaches and use of mathematical techniques, including calculus, to solve a wide range of problems in mechanics. Topics include static equilibrium, applications of Newton's laws and conservation principles, rotational dynamics, and fluids. Requires concurrent registration in PHYS 1151 and PHYS 1152.

**PHYS 1155. Physics for Engineering 2. (3 Hours)**

Continues PHYS 1151. Offers integrated lecture and laboratory. Covers electrostatics; capacitors; resistors and direct-current circuits; magnetism and magnetic induction; RC, LR, and LRC circuits; waves; electromagnetic waves; and radiation.

**Prerequisite(s):** (PHYS 1151 with a minimum grade of D- or PHYS 1161 with a minimum grade of D- or PHYS 1171 with a minimum grade of D- ); (MATH 1242 (may be taken concurrently) with a minimum grade of D- or MATH 1342 (may be taken concurrently) with a minimum grade of D- or MATH 2321 (may be taken concurrently) with a minimum grade of D- )

**Corequisite(s):** PHYS 1157

**Attribute(s):** NUpath Natural/Designed World

**PHYS 1156. Lab for PHYS 1155. (1 Hour)**

Accompanies PHYS 1155. Covers topics from the course through various experiments. Requires concurrent registration in PHYS 1155 and PHYS 1157.

**Attribute(s):** NUpath Analyzing/Using Data

**PHYS 1157. Interactive Learning Seminar for PHYS 1155. (1 Hour)**

Offers interactive problem solving for PHYS 1155. Emphasizes organized approaches and use of mathematical techniques, including calculus, to solve a wide range of problems in electricity, magnetism, and waves. Requires concurrent registration in PHYS 1155 and PHYS 1156.

**Corequisite(s):** PHYS 1155

**PHYS 1161. Physics 1. (4 Hours)**

Covers calculus-based physics. Offers the first semester of a two-semester integrated lecture and laboratory sequence intended primarily for science students. Covers Newtonian mechanics and fluids. Emphasizes the underlying concepts and principles. Takes applications from a wide variety of fields, such as life sciences and medicine, astro- and planetary physics, and so on. Includes topics such as forces, torque and static equilibrium, one-dimensional and three-dimensional motion, Newton's laws, dynamics friction, drag, work, energy and power, momentum and collisions, rotational dynamics, oscillations, pressure, fluids, and gravity.

**Prerequisite(s):** MATH 1241 with a minimum grade of D- or MATH 1251 with a minimum grade of D- or MATH 1341 (may be taken concurrently) with a minimum grade of D- or MATH 1342 (may be taken concurrently) with a minimum grade of D- or MATH 2321 (may be taken concurrently) with a minimum grade of D-

**Corequisite(s):** PHYS 1162, PHYS 1163

**Attribute(s):** NUpath Natural/Designed World

**PHYS 1162. Lab for PHYS 1161. (1 Hour)**

Accompanies PHYS 1161. Covers topics from the course through various experiments.

**Corequisite(s):** PHYS 1161, PHYS 1163

**Attribute(s):** NUpath Analyzing/Using Data

**PHYS 1163. Recitation for PHYS 1161. (0 Hours)**

Accompanies PHYS 1161. Offers an opportunity for interactive problem solving.

**Corequisite(s):** PHYS 1161, PHYS 1162

**PHYS 1165. Physics 2. (4 Hours)**

Continues PHYS 1161. Offers the second semester of a two-semester integrated lecture and laboratory sequence intended primarily for science students. Includes topics such as electrostatics; capacitors; resistors and direct-current circuits; magnetism and magnetic induction; RC, LR, and LRC circuits; waves; electromagnetic waves; and fluids.

**Prerequisite(s):** (PHYS 1151 with a minimum grade of D- or PHYS 1161 with a minimum grade of D- or PHYS 1171 with a minimum grade of D- or PHYS 1191 with a minimum grade of D-); (MATH 1342 (may be taken concurrently) with a minimum grade of D- or MATH 2321 (may be taken concurrently) with a minimum grade of D- )

**Corequisite(s):** PHYS 1166, PHYS 1167

**Attribute(s):** NUpath Natural/Designed World

**PHYS 1166. Lab for PHYS 1165. (1 Hour)**

Accompanies PHYS 1165. Covers topics from the course through various experiments.

**Corequisite(s):** PHYS 1165, PHYS 1167

**Attribute(s):** NUpath Analyzing/Using Data

**PHYS 1167. Recitation for PHYS 1165. (0 Hours)**

Accompanies PHYS 1165. Offers an opportunity for interactive problem solving.

**Corequisite(s):** PHYS 1165, PHYS 1166

**PHYS 1171. Physics 1 for Bioscience and Bioengineering. (3 Hours)**

Designed for students in engineering and science majors with a biologically related curriculum. Studies the fundamentals of calculus-based physics through a relationship with living systems. Includes topics such as kinematics of living systems, stress/strain/strength of biomaterials, fluid flow and boundary layers, aspiration and circulatory models, diffusion and random motion, and thermodynamics with examples from living systems.

**Prerequisite(s):** MATH 1241 (may be taken concurrently) with a minimum grade of D- or MATH 1251 (may be taken concurrently) with a minimum grade of D- or MATH 1340 (may be taken concurrently) with a minimum grade of D- or MATH 1341 (may be taken concurrently) with a minimum grade of D- or MATH 1342 (may be taken concurrently) with a minimum grade of D- or MATH 2321 (may be taken concurrently) with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World

**PHYS 1172. Lab for PHYS 1171. (1 Hour)**

Accompanies PHYS 1171. Experiments include measurement and error, forces in one dimension, work and energy on an air track, fluid flow, Brownian diffusion, uniform circular motion, and ideal gas laws. Requires concurrent registration in PHYS 1171 and PHYS 1173.

**Attribute(s):** NUpath Analyzing/Using Data

**PHYS 1173. Interactive Learning Seminar for PHYS 1171. (1 Hour)**

Offers interactive problem solving for PHYS 1171. Emphasizes organized approaches to solve a wide range of problems in the course. Requires concurrent registration in PHYS 1171 and PHYS 1172.

**PHYS 1175. Physics 2 for Bioscience and Bioengineering. (3 Hours)**

Continues PHYS 1171. Includes topics such as wave motion and hearing; electric fields (including application to biological membranes); direct current electrical circuits (including biological circuits); RC circuit models of ion channels; bioelectricity in marine organisms; electromagnetic waves and optics; modern physics (including radioactive decay, applications of radioactivity in nuclear medicine, and carbon 14 dating).

**Prerequisite(s):** (PHYS 1151 with a minimum grade of D- or PHYS 1161 with a minimum grade of D- or PHYS 1171 with a minimum grade of D- ); (MATH 1242 (may be taken concurrently) with a minimum grade of D- or MATH 1342 (may be taken concurrently) with a minimum grade of D- or MATH 2321 (may be taken concurrently) with a minimum grade of D- )

**Attribute(s):** NUpath Natural/Designed World

**PHYS 1176. Lab for PHYS 1175. (1 Hour)**

Accompanies PHYS 1175. Experiments include standing waves, electric charge/field, DC circuits, gel electrophoresis, geometric optics, light spectroscopy, and radioactive decay. Requires concurrent registration in PHYS 1175 and PHYS 1177.

**Attribute(s):** NUpath Analyzing/Using Data

**PHYS 1177. Interactive Learning Seminar for PHYS 1175. (1 Hour)**

Offers interactive problem solving for PHYS 1175. Emphasizes organized approaches to solve a wide range of problems in the course. Requires concurrent registration in PHYS 1175 and PHYS 1176.

**PHYS 1191. Foundations of Theoretical Physics. (4 Hours)**

Presents a comprehensive, self-contained introduction to the conceptual and mathematical foundations of theoretical physics. Commences with an integrated, first-principles approach to its five main areas: analytical dynamics, fields, statistical physics, relativity, and quantum theory. Focuses mostly on classical mechanics. Constitutes the first half of a two-semester calculus-based introductory physics sequence for science majors. Designed for students with preparation in Newtonian mechanics or those with advanced math preparation.

**Prerequisite(s):** (MATH 1241 with a minimum grade of D- or MATH 1242 (may be taken concurrently) with a minimum grade of D- or MATH 1341 with a minimum grade of D- or MATH 1342 (may be taken concurrently) with a minimum grade of D- or MATH 2321 (may be taken concurrently) with a minimum grade of D- )

**Corequisite(s):** PHYS 1192, PHYS 1193

**Attribute(s):** NUpath Formal/Quant Reasoning, NUpath Natural/Designed World

**PHYS 1192. Lab for PHYS 1191. (1 Hour)**

Accompanies PHYS 1191. Covers topics from the course through various experiments.

**Corequisite(s):** PHYS 1191, PHYS 1193

**Attribute(s):** NUpath Analyzing/Using Data

**PHYS 1193. Recitation for PHYS 1191. (0 Hours)**

Accompanies PHYS 1191. Offers an opportunity for interactive problem solving.

**Corequisite(s):** PHYS 1191, PHYS 1192

**PHYS 1211. Computational Problem Solving in Physics. (4 Hours)**

Introduces students to computational problem-solving techniques with common computer languages used in the physical sciences. Begins with programming basics of data handling, visualization tools, random number generators, functions, and control statements and expands to more advanced topics of interpolation, numeric integration, numeric derivatives, ordinary differential equations, and some Monte Carlo techniques. Explores topics contextually using physical models and problems.

**Prerequisite(s):** (PHYS 1155 (may be taken concurrently) with a minimum grade of D or PHYS 1165 (may be taken concurrently) with a minimum grade of D or PHYS 1175 (may be taken concurrently) with a minimum grade of D ); (MATH 1342 (may be taken concurrently) with a minimum grade of D or MATH 2321 (may be taken concurrently) with a minimum grade of D )

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**PHYS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHYS 2303. Modern Physics. (4 Hours)**

Reviews experiments demonstrating the atomic nature of matter, the properties of the electron, the nuclear atom, the wave-particle duality, spin, and the properties of elementary particles. Discusses, mostly on a phenomenological level, such subjects as atomic and nuclear structure, properties of the solid state, and elementary particles. Introduces the special theory of relativity.

**Prerequisite(s):** (PHYS 1155 with a minimum grade of D- or PHYS 1165 with a minimum grade of D- or PHYS 1175 with a minimum grade of D- ); MATH 2321 (may be taken concurrently) with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World

**PHYS 2371. Electronics. (3 Hours)**

Covers the physics underlying computers and our modern electronic world. Focuses on principles of semiconductor devices (diodes, transistors, integrated circuits, LEDs, photovoltaics); analog techniques (amplification, AC circuits, resonance); digital techniques (binary numbers, NANDs, logic gates, and circuits); electronic subsystems (operational amplifiers, magnetoelectronics, optoelectronics); and understanding commercial electronic equipment. Lab experiments are designed to investigate the properties of discrete and integrated devices and use them to design and build circuits.

**Prerequisite(s):** PHYS 1165 with a minimum grade of D- or PHYS 1155 with a minimum grade of D- or PHYS 1175 with a minimum grade of D-

**Corequisite(s):** PHYS 2372

**Attribute(s):** NUpath Natural/Designed World

**PHYS 2372. Lab for PHYS 2371. (1 Hour)**

Accompanies PHYS 2371. Illustrates topics from the lecture course through various hands-on experimental projects. Covers the process of electronics design from a goal-oriented perspective. Students are expected to consider their own electronics design project and build a prototype device that accomplishes a specific purpose.

**Corequisite(s):** PHYS 2371

**Attribute(s):** NUpath Creative Express/Innov

**PHYS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHYS 2991. Research in Physics. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated seven times.

**PHYS 3111. Astrophysical Processes: Decoding the Universe. (4 Hours)**

Introduces the important astrophysical processes happening in the universe, including interactions between astrophysical matter and radiation (scattering, absorption, refraction); interaction between astrophysical matter and space (Doppler effect and gravitational lensing); and emission of radiation from astrophysical sources (continuous and line). By the end of the course, successful students should be able to recognize the nature of an astrophysical source from the signal as detected on Earth or in space.

**Prerequisite(s):** (PHYS 1155 with a minimum grade of D- or PHYS 1165 with a minimum grade of D- ); PHYS 2303 (may be taken concurrently) with a minimum grade of D-

**PHYS 3211. Advanced Computational Problem Solving in Physics. (4 Hours)**

Explores the application of scientific computing languages, such as Python, in modeling the physical world and advancing physics. Topics include linear and non-linear systems, eigensystems, ordinary differential equations, boundary value problems, Monte Carlo techniques, and machine learning. Contextualizes topics within natural phenomena, physics models, and physics problems. Emphasizes developing proficiency in computational methods for modeling nature and solving complex physical phenomena.

**Prerequisite(s):** (MATH 2331 with a minimum grade of C- or MATH 2341 with a minimum grade of C- ); PHYS 2303 with a minimum grade of C-

**Attribute(s):** NUpath Analyzing/Using Data

**PHYS 3600. Advanced Physics Laboratory. (4 Hours)**

Introduces research through experiments that go beyond the simple demonstration of basic physical principles found in introductory physics courses. Data are taken to higher precision and the analysis is more in-depth. Experiments focus on lasers, fiber-optic communication, spectroscopy, Faraday rotation, speed of light, semiconductor physics, Hall effect, fuel cells, and Fourier analysis of music and sound. Lab reports are assessed on organization, format, grammar, and style. Offers students an opportunity to significantly improve their abilities in written scientific communication.

**Prerequisite(s):** PHYS 2303 with a minimum grade of D- ; (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World, NUpath Writing Intensive

**PHYS 3601. Classical Dynamics. (4 Hours)**

Covers advanced topics in classical mechanics including vector kinematics, harmonic oscillator and resonance, generalized coordinates, Lagrange's equations, central forces and the Kepler problem, rigid body motion, and mathematical methods in physics.

**Prerequisite(s):** (PHYS 1155 with a minimum grade of D- or PHYS 1165 with a minimum grade of D- or PHYS 1175 with a minimum grade of D- ); (MATH 2341 (may be taken concurrently) with a minimum grade of D- or MATH 2351 (may be taken concurrently) with a minimum grade of D- )

**Attribute(s):** NUpath Natural/Designed World

**PHYS 3602. Electricity and Magnetism 1. (4 Hours)**

First course of a two-course sequence in electricity, magnetism, and electromagnetic theory. Covers electrostatics and dielectric materials, magnetostatics and magnetic materials, currents in conductors, induction, displacement currents, computer solutions of EM problems, and Maxwell's equations.

**Prerequisite(s):** (PHYS 1155 with a minimum grade of D- or PHYS 1165 with a minimum grade of D- or PHYS 1175 with a minimum grade of D- ); MATH 2321 with a minimum grade of D- ; (MATH 2341 (may be taken concurrently) with a minimum grade of D- or MATH 2351 (may be taken concurrently) with a minimum grade of D- )

**Attribute(s):** NUpath Natural/Designed World

**PHYS 3603. Electricity and Magnetism 2. (4 Hours)**

Continues PHYS 3602. Focuses on electromagnetic waves in vacua and matter, electrodynamics and radiation, and computer visualization of electromagnetic fields. Also considers special relativity.

**Prerequisite(s):** PHYS 3602 with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World

**PHYS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHYS 4111. Multimessenger Astrophysics. (4 Hours)**

Investigates the variety of astrophysical signals produced by galactic and extragalactic sources, in connection with and independently from the electromagnetic wave (EM) signals. Introduces the basic theory behind the production, transmission, and detection of astrophysical neutrinos, cosmic rays, dark matter, and gravitational waves. Topical in nature, the course offers a solid introduction to the newest discoveries in astrophysics.

**Prerequisite(s):** PHYS 2303 with a minimum grade of D-

**PHYS 4112. Principles of Radio Astronomy. (4 Hours)**

Introduces the fundamentals of radio astronomy, including electromagnetic waves and their properties, emission mechanisms and astronomical radio sources, radio telescope instrumentation, and experimental methods and techniques. Offers hands-on experience through an embedded lab component and fieldwork that allows students to operate a radio telescope array located on campus, enabling them to record and analyze data from astronomical sources. Advanced topics include radio interferometry and aperture synthesis.

**Prerequisite(s):** PHYS 2303 with a minimum grade of C

**PHYS 4115. Quantum Mechanics. (4 Hours)**

Focuses on observations of macroscopic and microscopic bodies. Covers the uncertainty principle and wave-particle duality; probability amplitudes; Schrödinger wave theory and one-dimensional problems, Schrödinger equation in three dimensions; and angular momentum and the hydrogen atom.

**Prerequisite(s):** PHYS 2303 with a minimum grade of D-

**Attribute(s):** NUpath Formal/Quant Reasoning, NUpath Natural/Designed World

**PHYS 4211. Artificial Intelligence for Physical Science. (4 Hours)**

Introduces artificial intelligence (AI) and machine learning (ML) approaches that are powering data-driven scientific research. Gives students a broad overview of why and how ML is used in multiple science disciplines. Introduces the underlying principles of a diverse set of ML models and AI frameworks. Discusses how to combine domain knowledge with AI tools to advance research and solve challenging problems in multiple fields of physical science.

**Prerequisite(s):** (EECE 2140 with a minimum grade of D+ or PHYS 1211 with a minimum grade of D+ or PHYS 3211 (may be taken concurrently) with a minimum grade of D+ ); PHYS 2303 (may be taken concurrently) with a minimum grade of D+

**PHYS 4305. Thermodynamics and Statistical Mechanics. (4 Hours)**

Focuses on first and second laws of thermodynamics, entropy and equilibrium, thermodynamic potentials, elementary kinetic theory, statistical mechanics, and the statistical interpretation of entropy. Utilizes the principles of quantum mechanics to describe the behavior of thermodynamic/statistically-large systems such as quantum gases.

**Prerequisite(s):** (PHYS 1155 with a minimum grade of D- or PHYS 1165 with a minimum grade of D- or PHYS 1175 with a minimum grade of D- ); MATH 2321 (may be taken concurrently) with a minimum grade of D- ; PHYS 2303 with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World

**PHYS 4606. Mathematical and Computational Methods for Physics. (4 Hours)**

Covers advanced mathematical methods topics that are commonly used in the physical sciences, such as complex calculus, Fourier transforms, special functions, and the principles of variational calculus. Applies these methods to computational simulation and modeling exercises. Introduces basic computational techniques and numerical analysis, such as Newton's method, Monte Carlo integration, gradient descent, and least squares regression. Uses a simple programming language, such as MATLAB, for the exercises.

**Prerequisite(s):** PHYS 2303 with a minimum grade of D- ; MATH 2321 with a minimum grade of D- ; (MATH 2341 with a minimum grade of D- or MATH 2351 with a minimum grade of D- )

**Attribute(s):** NUpath Formal/Quant Reasoning

**PHYS 4621. Biological Physics 1. (4 Hours)**

Offers an introduction to biophysics focusing on development and implementation of physical models for various biophysical processes that occur in living organisms and in living cells. Topics covered, some of which are explored through computational examples, include thermodynamics of solutions and cells, randomness, diffusion, entropy, membranes, electrostatics, and electricity in cells.

**Prerequisite(s):** PHYS 2303 with a minimum grade of D-

**Attribute(s):** NUpath Natural/Designed World

**PHYS 4623. Medical Physics. (4 Hours)**

Introduces the physical principles and basic mathematical methods underlying the various modalities of medical imaging. These include computed tomography (CT), magnetic resonance (MRI), positron emission tomography (PET), single-photon emission tomography (SPECT), and ultrasound. Covers nuclear physics and the interaction of radiation with biological matter with application to radiation therapy.

**Prerequisite(s):** MATH 2321 with a minimum grade of D-

**PHYS 4651. Medical Physics Seminar 1. (4 Hours)**

Offers the first part of a seminar series conducted by expert practitioners from Boston-area hospitals. Examines the clinical applications of medical imaging methods (CT, MRI, and PET), the clinical applications of radiation therapy, and the clinical applications of lasers and optical techniques. Includes site visits to local hospitals and medical instrumentation companies.

**Prerequisite(s):** PHYS 4623 with a minimum grade of D-

**PHYS 4652. Medical Physics Seminar 2. (4 Hours)**

Continues PHYS 4651. Further examines the clinical applications of medical imaging methods (CT, MRI, and PET), the clinical applications of radiation therapy, and the clinical applications of lasers and optical techniques.

**Prerequisite(s):** PHYS 4623 with a minimum grade of D-

**PHYS 4949. Experiential Physics. (0 Hours)**

Offers students an opportunity to demonstrate their readiness to present relevant experience connected with their major by giving a presentation connected with a co-op and/or research experience during a meeting of the Society of Physics Students or by showing evidence and documentation of a presentation at a professional meeting or at an appropriate campus event.

**PHYS 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**PHYS 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** PHYS 4970 with a minimum grade of D-

**PHYS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHYS 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**PHYS 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of a member of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**PHYS 4996. Experiential Education Directed Study. (4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major. Restricted to those students who are using it to fulfill their experiential education requirement. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**PHYS 5113. Particle Physics. (4 Hours)**

Introduces the physics of elementary particles and the fundamental interactions among them. Topics include classification of particles, electromagnetic interactions, strong and weak nuclear forces, mesons and nucleons, quarks and gluons, and unified theories of elementary particle interactions.

**Prerequisite(s):** (PHYS 2303 with a minimum grade of D- ; PHYS 4115 with a minimum grade of D- ) or graduate program admission

**Attribute(s):** NUpath Natural/Designed World

**PHYS 5114. Physics and Applications of Quantum Materials. (4 Hours)**

Introduces students to the quantum materials, the nature and origins of their unique behaviors, and how these systems can be used to enable new quantum technologies. Beginning with a description of the electronic structure of solids, describes how interactions between electrons and spins can manifest electrical and magnetic properties that cannot be explained with a classical description and how isolated defects in solids can be utilized for quantum technologies.

**Prerequisite(s):** (PHYS 2303 with a minimum grade of D- ; PHYS 3602 with a minimum grade of D- ; (PHYS 2305 with a minimum grade of D- or PHYS 4305 with a minimum grade of D- ); PHYS 4115 (may be taken concurrently) with a minimum grade of D- ) or graduate program admission

**Attribute(s):** NUpath Natural/Designed World

**PHYS 5116. Network Science 1. (4 Hours)**

Introduces network science and the set of analytical, numerical, and modeling tools used to understand complex networks emerging in nature and technology. Focuses on the empirical study of real networks, with examples coming from biology (metabolic, protein interaction networks), computer science (World Wide Web, Internet), or social systems (e-mail, friendship networks). Shows the organizing principles that govern the emergence of networks and the set of tools necessary to characterize and model them. Covers elements of graph theory, statistical physics, biology, and social science as they pertain to the understanding of complex systems.

**Prerequisite(s):** PHYS 2303 with a minimum grade of D- or graduate program admission

**Attribute(s):** NUpath Natural/Designed World

**PHYS 5117. Advanced Astrophysics Topics. (4 Hours)**

Seeks to provide an understanding of our universe through the connection between cosmology and particle physics. Covers basic concepts of the modern universe, stellar structure and evolution, and dark matter theory while introducing recent astrophysical observations and experiments.

**Prerequisite(s):** (PHYS 2303 with a minimum grade of D- ; (PHYS 2305 with a minimum grade of D- or PHYS 4305 with a minimum grade of D- )) or graduate program admission

**PHYS 5118. General Relativity and Cosmology. (4 Hours)**

Introduces basic concepts in the general theory of relativity, including Riemannian geometry and Einstein's field equations. These concepts are applied in studying the standard model of cosmology. Topics include thermodynamics in an expanding universe, dark matter and dark energy, and modern theories of cosmology.

**Prerequisite(s):** (PHYS 2303 with a minimum grade of D- ; (PHYS 2305 with a minimum grade of D- or PHYS 4305 with a minimum grade of D- )) or graduate program admission

**PHYS 5125. Advanced Quantum Mechanics. (4 Hours)**

Introduces time-independent and time-dependent perturbation theory. Covers hydrogen fine structure, Zeeman effect, helium splitting, variational principle, adiabatic approximation, scattering theory, second quantization, and modern topics such as theory of quantum entanglement, quantum computing, and quantum biology.

**Prerequisite(s):** PHYS 4115 with a minimum grade of D- or graduate program admission

**PHYS 5211. Introduction to Scientific Computing. (4 Hours)**

Presents areas of study or practice to which computational techniques can fruitfully be applied such as climate change, epidemiology, air travel, and finance. Offers students an opportunity to understand the strengths and limitations of frequently used computing methods to tackle current open problems. Identifies ways to validate the results obtained with such techniques. Introduces the background needed to understand well-established numerical and computational approaches and explores their use through practical examples from different disciplines such as physics, chemistry, biology, and finance.

**Prerequisite(s):** (MATH 2331 with a minimum grade of C+ or MATH 2341 with a minimum grade of C+ ) or graduate program admission

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Natural/Designed World

**PHYS 5260. Introduction to Nanoscience and Nanotechnology. (4 Hours)**

Focuses on reviewing the basic scientific concepts relevant to this field and also gives a broad overview of the current state-of-the-art in research and technology. Nanotechnology promises to transform twenty-first century technology by exploiting phenomena exhibited by nanoscaled materials. This technology is expected to have significant impact in diverse areas such as computers, electronics, health, etc. Successful technological advancement of this field requires that we have a fundamental understanding of the "science" of these materials. This course comprises a series of lectures on various topics: development of nanofabrication methods, advanced microscopy techniques, fabrication of novel nanomaterials, investigation of their fundamental properties and device applications. Provides a strong introduction for students interested in nanoscience and technology.

**Prerequisite(s):** PHYS 2303 with a minimum grade of D- or graduate program admission

**Attribute(s):** NUpath Natural/Designed World

**PHYS 5318. Principles of Experimental Physics. (4 Hours)**

Designed to introduce students to the techniques of modern experimental physics. Topics include communication and information physics, signal processing and noise physics, applied relativity physics, detector techniques, semiconductor and superconductor physics, nanoscale microscopy and manipulation, and lasers and quantum optics.

**Prerequisite(s):** PHYS 2303 with a minimum grade of D- or graduate program admission

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Capstone Experience, NUpath Natural/Designed World, NUpath Writing Intensive

**PHYS 5352. Quantum Computation and Information. (4 Hours)**

Introduces the foundations of quantum computation and information, including finite dimensional quantum mechanics, gates and circuits, quantum algorithms, quantum noise, and error-correcting codes. Assumes a working knowledge of linear algebra and matrix analysis, but no prior experience with quantum theory or algorithms is required.

**PHYS 5608. Magnetic Materials for Next-Generation Electronics. (4 Hours)**

Covers the fundamentals of magnetic materials. Focuses on the frontiers of research activities on magnetic materials for next-generation sensors and electronics. Topics include magnetic units, magnetic materials classification, origin of ferromagnetism and ferrimagnetism, magnetic anisotropies, magnetostriction, magnetic domain theory, ferromagnetic/ferrimagnetic resonance, magnetodynamics, and magnetic material characterization techniques. Explores soft and hard magnetic materials and their applications, which include magnetic sensors, antennas, hard disk drives, magnetic materials for power supplies on chips, RF and microwave magnetic materials and devices, and spintronics. Also covers magnetic characterization techniques such as vibrating sample magnetometry, B-H looper, ferromagnetic resonance spectrometry, magneto-optic Kerr effect imaging, and magnetic sensing.

**Prerequisite(s):** (MATH 2321 with a minimum grade of D- ; (PHYS 1155 with a minimum grade of D- or PHYS 1165 with a minimum grade of D- )) or graduate program admission

**PHYS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHYS 7200. Methods of Advanced Problem Solving. (4 Hours)**

Designed to improve the ability of students to solve physics problems, which are of the same degree of difficulty as problems that often appear on the qualifying exam.

**PHYS 7210. Introduction to Research in Physics. (0 Hours)**

Offers a weekly seminar to introduce first- and second-year physics graduate students to research being done in the Physics department by advanced physics graduate students and faculty. May be repeated without limit.

**PHYS 7220. Methods for Teaching in the Introductory Physics Laboratory 1. (0 Hours)**

Introduces first-year physics graduate students to the role of teaching assistant (TA) in the laboratory. Designed to prepare TAs for the experiments they are required to teach undergraduate students. Focuses on improving their teaching and grading effectiveness.

**PHYS 7230. Methods for Teaching Introductory Physics Laboratory 2. (0 Hours)**

Continues PHYS 7220, offered to first-year graduate physics teaching assistants. Designed to prepare TAs for the experiments they teach to undergraduate students. Offers students an opportunity to improve their teaching and grading effectiveness.

**Prerequisite(s):** PHYS 7220 with a minimum grade of S

**PHYS 7301. Classical Mechanics/Math Methods. (4 Hours)**

Covers mathematical methods of physics and classical mechanics. Topics include differential equations, boundary value problems, functions of a complex variable, linear vector spaces, Green's functions, Lagrangian and Hamiltonian mechanics, linear oscillators, and scattering. May include additional topics as time permits.

**PHYS 7302. Electromagnetic Theory. (4 Hours)**

Analyzes Maxwell's equations in vacuum and special relativity. Topics include electric and magnetic fields due to known sources with boundary conditions, radiation fields, bremsstrahlung, synchrotron radiation, the energy-momentum tensor for the electromagnetic field, fields in material media, boundary conditions at the interface between two media, and scattering of radiation. May include additional topics as time permits.

**PHYS 7305. Statistical Physics. (4 Hours)**

Briefly reviews thermodynamics. Topics include the principles of statistical mechanics and statistical thermodynamics; density matrix; theory of ensembles; Fermi-Dirac and Bose-Einstein statistics, application to gases, liquids, and solids; theory of phase transitions; and thermodynamics of electric and magnetic systems, transport phenomena, random walks, and cooperative phenomena.

**PHYS 7315. Quantum Theory 1. (4 Hours)**

Explores the experimental basis of quantum theory, the Schrödinger equation, and probability interpretation of wave mechanics. Topics include the uncertainty principle, application to one-dimensional problems, the harmonic oscillator, orbital angular momentum, and the central force problem.

**PHYS 7316. Quantum Theory 2. (4 Hours)**

Continues PHYS 7315. Topics include quantum theory of scattering; Born approximation; phase-shift analysis; introduction to S-matrix theory; general formulation quantum mechanics in Hilbert space; spin; identical particles and symmetrization principle; time-independent and time-dependent perturbation theory; semiclassical theory of radiation and atomic spectra; addition of angular momentum; Wigner-Eckart theorem; quantum theory of radiation; and absorption, emission, and scattering of photons. Also introduces free particle Dirac equation.

**Prerequisite(s):** PHYS 7315 with a minimum grade of C-

**PHYS 7321. Computational Physics. (4 Hours)**

Covers basic numerical methods for differentiation, integration, and matrix operations used in linear algebra problems, discrete Fourier transforms, and standard and stochastic ordinary and partial differential equations. Specific applications of these methods may include classical chaos, computation of eigenstates of simple quantum systems, classical phase transitions, boundary value problems, pattern formation, and molecular dynamics and classical/quantum Monte Carlo methods to simulate the equilibrium and nonequilibrium properties of condensed phases.

**PHYS 7322. Nonequilibrium Physics. (4 Hours)**

Covers selected topics in nonequilibrium statistical mechanics and nonlinear physics to be selected by the instructor, with emphasis on classical theories of solids, fluids, and other more complex phases of matter. Topics may include Brownian motion, including Langevin and Fokker-Planck equations; linear response theory and transport phenomena; nonequilibrium phase transitions, including nucleation and phase-ordering kinetics; elasticity theory and fluid mechanics; and nonlinear dynamics and pattern formation.

**Prerequisite(s):** PHYS 7305 with a minimum grade of C

**PHYS 7323. Elementary Particle Physics. (4 Hours)**

Presents a survey of the present state of elementary particle physics, suitable for all graduate students. Topics include overview of strong interactions and their connection to nuclear physics; nonrelativistic quark structure of strongly interacting particles (hadrons); color and the SU(3) Yang-Mills theory of strong interactions; coupling constant renormalization and asymptotic freedom; and the parton model of scattering. Covers weak interactions including phenomenology of the Fermi V-A theory; universality; and neutrino scattering. Studies the Glashow-Weinberg-Salam theory including unification of weak and electromagnetic interaction, neutral currents, the Higgs mechanism, quark masses and mixing, neutrino masses, and neutrino oscillation. Offers experimental support for the standard model. Also examines supersymmetry including the hierarchy problem and broken supersymmetry; role of supersymmetry in cosmology.

**PHYS 7324. Condensed Matter Physics. (4 Hours)**

Explores condensed matter physics. Topics include Drude and Sommerfeld models of electrons in metals, crystal structure, one-electron states in crystal lattices, Bloch's theorem, semiclassical theory of conduction, semiconductors and semiconducting devices, effects of electron-electron interactions, lattice vibrations and the classical and quantum theories of specific heat, optical properties of solids, investigation of crystal structure and excited states of crystals by x-ray and neutron scattering, simple transport theory based on the Boltzmann equation, and magnetic properties of solids.

**PHYS 7325. Quantum Field Theory 1. (4 Hours)**

Introduces the principles of quantum field theory. Topics include canonical quantization of scalar and spinor fields, functional integral methods, perturbation theory, regularization and renormalization, and symmetry breaking. Emphasizes applications to particle physics and condensed matter phenomena.

**PHYS 7326. Quantum Field Theory 2. (4 Hours)**

Presents the quantum theory of gauge fields and their interactions, as well as advanced topics in quantum field theory. Additional topics covered may include Lie groups and Yang-Mills theory, asymptotic freedom, perturbation theory anomalies, and applications to phase transitions.

**Prerequisite(s):** PHYS 7325 with a minimum grade of C-

**PHYS 7332. Network Science Data 2. (4 Hours)**

Focuses on practical exercises in real network data. Offers students an opportunity to learn how to retrieve network data from the real world, analyze network structures and properties, study dynamical processes on top of the networks, and visualize networks. The main programming language used in this course is the current industry standard. This is an interdisciplinary course.

**Prerequisite(s):** PHYS 5116 with a minimum grade of C ; PHYS 7331 with a minimum grade of C

**PHYS 7335. Dynamical Processes in Complex Networks. (4 Hours)**

Immerses students in the modeling of dynamical processes (contagion, diffusion, routing, consensus formation, etc.) in complex networks. Includes guest lectures from local and national experts working in process modeling on networks. Dynamical processes in complex networks provide a rationale for understanding the emerging tipping points and nonlinear properties that often underpin the most interesting characteristics of sociotechnical systems. Reviews the recent progress in modeling dynamical processes that integrates the complex features and heterogeneities of real-world systems.

**Prerequisite(s):** NETS 5116 with a minimum grade of C- or PHYS 5116 with a minimum grade of C-

**PHYS 7731. Physics of Biological Processes and Living Systems 1. (4 Hours)**

Provides an overview of the following topics: The use of physical science principles to model biological processes; Equilibrium systems including receptor-ligand binding, polymer conformation and protein folding; Chemical kinetics including the Michaelis-Menten model and cytoskeletal dynamics; Stochastic effects and the master equation approach; Motor proteins and non-equilibrium systems; Ion channels, and electrical effects including the Hodgkin-Huxley model; Reaction-diffusion processes and their possible role in developmental biology.

**PHYS 7733. Topics: Elementary Particle Physics and Cosmology. (4 Hours)**

Covers unified theories including evidence for supersymmetric SU(5) unification of couplings, and the grand unified scale and proton decay. Discusses particle physics and cosmology including a brief introduction to Einstein's theory of general relativity, candidates for dark matter, inflation and the primordial fluctuations, and the problem of the cosmological constant. Examines developments leading to string theory including normal mode expansion; open and closed strings; deduction of D-26 for bosonic and D-10 for superstrings; scattering amplitudes in strings; heterotic string; compactifications on the torus, orbifolds, and Calabi-Yau manifolds; 4-D strings; and superstring phenomenology. Explores physics with extra dimensions including gravity at small distances, branes, and new approaches to the hierarchy problem. May be repeated without limit.

**PHYS 7734. Topics: Condensed Matter Physics. (4 Hours)**

Covers selected advanced topics in the theory of solids to be chosen each time by the interested student and instructor. Topics may include theory of normal metals, Hartree-Fock and random phase approximations, optical and transport properties, solid-state plasmas, Raman spectroscopy, quasiparticles and collective excitations, quantum solids, and amorphous solids. May be repeated without limit.

**Prerequisite(s):** PHYS 7324 with a minimum grade of C-

**PHYS 7741. Physics of Biological Processes and Living Systems 2. (4 Hours)**

Continues PHYS 7731. Focuses on theoretical approaches to understand complex emergent properties of living systems on molecular to organ scales. Topics include the physics of biopolymers with applications to DNA stretching and structural transitions, biomolecular reactions and their analysis in the framework of nonlinear dynamics including models of collective oscillations, the structure and dynamics of small and large transcriptional regulatory networks in bacteria and eukaryotic cells, Hodgkin-Huxley equations and their extension to reaction-diffusion models of wave dynamics in biological excitable media, Turing patterns and spatiotemporal control of cell fate during development, single and collective cell migration, neural networks in the brain and bio-inspired artificial neural networks. Includes the analysis of several illustrative experimental data sets.

**Prerequisite(s):** PHYS 7731 with a minimum grade of C- ; PHYS 7321 with a minimum grade of C-

**PHYS 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHYS 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of a member of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**PHYS 7990. Thesis. (1-4 Hours)**

Undertakes a master's thesis in a selected topic in experimental or theoretical physics. Written thesis required. May be repeated without limit.

**PHYS 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**PHYS 9984. Advanced Research. (1-8 Hours)**

Provides an opportunity for advanced students to work with an individual instructor on a topic related to current research. The instructor and student negotiate a written agreement as to what topic(s) are covered and what written or laboratory work forms the basis for the grade. Viewed as a lead-in to thesis research. May be repeated without limit.

**PHYS 9986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**PHYS 9990. Dissertation Term 1. (0 Hours)**

Offers experimental and theoretical work for PhD candidates. Requires written thesis and final oral exam.

**Prerequisite(s):** PHYS 9000 with a minimum grade of S

**PHYS 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** PHYS 9990 with a minimum grade of S

**PHYS 9996. Dissertation Continuation. (0 Hours)**

Offers experimental and theoretical work for PhD candidates. Requires written thesis and final oral exam.

**Prerequisite(s):** PHYS 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Physics - CPS (PHY)

**PHY 1200. Physics 1. (3 Hours)**

Offers the first semester of a two-semester introduction to algebra-based physics. Emphasizes the underlying concepts and principles of Newtonian physics and fluids. Introduces measurement, estimating, and Newtonian mechanics. Topics covered include kinematics, dynamics, translational motion, vectors, circular motion, gravitation, work, energy, power, momentum, and rotational motion. Further topics covered include static equilibrium, elasticity and fracture, fluids, vibrations, waves, and sound.

**Prerequisite(s):** MTH 1100 with a minimum grade of D-

**Corequisite(s):** PHY 1201

**Attribute(s):** NUpath Natural/Designed World

**PHY 1201. Lab for PHY 1200. (1 Hour)**

Accompanies PHY 1200. Covers topics from the course through various experiments.

**Corequisite(s):** PHY 1200

**PHY 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHY 2200. Physics 2. (3 Hours)**

Offers the second semester of a two-semester introduction to algebra-based physics. Emphasizes the underlying concepts and principles of electricity and thermodynamics. Introduces temperature, the kinetic theory of matter, heat, the laws of thermodynamics, electricity, and Coulomb's law. Topics covered include electric charge and fields, electric potential, electric current circuits, electric capacitance, magnetic forces and fields, and electromagnetic induction. Further topics covered include alternating current circuits, magnetism, electromagnetic waves, the nature of light, and geometric optics.

**Prerequisite(s):** PHY 1200 with a minimum grade of D- ; PHY 1201 with a minimum grade of D-

**Corequisite(s):** PHY 2201

**Attribute(s):** NUpath Natural/Designed World

**PHY 2201. Lab for PHY 2200. (1 Hour)**

Accompanies PHY 2200. Covers topics from the course through various experiments.

**Prerequisite(s):** PHY 1200 with a minimum grade of D- ; PHY 1201 with a minimum grade of D-

**Corequisite(s):** PHY 2200

**PHY 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHY 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHY 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHY 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic.

**PHY 4994. Internship. (1-4 Hours)**

Provides students with an opportunity for internship work.

**Attribute(s):** NUpath Integration Experience

**PHY 4995. Practicum. (1-4 Hours)**

Provides eligible students with an opportunity for practical experience.

**PHY 4996. Experiential Education Directed Study. (1-4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major.

**Attribute(s):** NUpath Integration Experience

**PHY 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

## Political Science (POLS)

**POLS 1000. Political Science at Northeastern. (1 Hour)**

Introduces first-year political science majors to the discipline, the department, and the University as a whole; familiarizes students with the skills needed for success as a university student.

**POLS 1150. American Government. (4 Hours)**

Analyzes the system of politics and government in the United States. Topics include the philosophical basis, historical origins, design, and functioning of the Constitution as well as formal government institutions. Examines the influence of public opinion, political behavior and participation, parties, and interest groups.

**Attribute(s):** NUpath Societies/Institutions

**POLS 1155. Comparative Politics. (4 Hours)**

Presents a comparative study of political organization and behavior in a range of countries beyond the United States. Topics includes political culture, political economy, governing institutions, leadership, and political participation.

**POLS 1160. International Relations. (4 Hours)**

Introduces a broad study of international relations, encompassing both theoretical perspectives and empirical knowledge. Reviews the role of states as well as international and nongovernmental organizations in dealing with security and war, terrorism, human rights, trade, globalization, and environmental protection, among other important contemporary issues.

**Attribute(s):** NUpath Societies/Institutions

**POLS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**POLS 2282. The Holocaust and Comparative Genocide. (4 Hours)**

Examines the origins of the Holocaust, perpetrators and victims, and changing efforts to come to terms with this genocide. The Holocaust, the murder of 6 million Jews by Germans in Nazi-occupied Europe during World War II, is one of the crucial events of modern history. Investigates the uniqueness of the Holocaust relative to other acts of ethnic cleansing or genocide, including mass death in the New World and mass murder in Armenia, Bosnia, and Rwanda.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**POLS 2290. Asian American Politics. (4 Hours)**

Explores the political developments that gave rise to the term "Asian America" in the 1960s and investigates theoretical questions about the complexities and pluralities of the contemporary Asian American experience. Examines Asian American political participation around current issues such as immigration and migration patterns, intragroup coalitions, racial stereotypes, data disaggregation, political representation, voting patterns, policy preferences, and more. Considers the role of American political institutions—including federal, state, and local governments—and how public policies at all levels shape the political lives of Asian Americans in the United States.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**POLS 2325. Ancient Philosophy and Political Thought. (4 Hours)**

Examines the philosophers of classical Greece, primarily Socrates, Plato, and Aristotle. These philosophers examined the nature of the material world, of the city, and of the person. The course takes up both the moral and political writings as well as the metaphysical writings. Devotes considerable attention to major works such as Plato's *Republic*. Some time is given to early Greek philosophers, to the Sophists, and to later developments. Requires written analysis of philosophical texts. PHIL 2325 and POLS 2325 are cross-listed.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C

**Attribute(s):** NUpath Ethical Reasoning, NUpath Interpreting Culture, NUpath Writing Intensive

**POLS 2328. Modern Political Thought. (4 Hours)**

Introduces students to a range of authors who are considered to be most influential in shaping Western political thought and who remain highly relevant in informing contemporary political debate. Offers students an opportunity to think critically about some of the fundamental questions pertaining to political practice—the nature of ideas, institutions, and processes and how to understand and evaluate them.

**POLS 2330. American Political Thought. (4 Hours)**

Analyzes the fundamental ideas in U.S. political thought that have shaped U.S. political institutions and policies, including liberalism, neoliberalism, conservatism, and nationalism. Examines the historic roots of each viewpoint and their impact. Major topics may include Locke and the liberal tradition, republicanism, Puritan political thought, the American Revolution, the writing of the Constitution, the growth of federal power, executive power, judicial review, and the debate over slavery. Explores the ongoing interaction of political thought and the political process in contemporary U.S. society.

**POLS 2332. Contemporary Political Thought. (4 Hours)**

Introduces students to a range of positions in contemporary political theory, familiarizing them with key texts, authors, and debates, such as those concerning critiques of power, global justice, and pluralism. Explores a range of methodological and theoretical approaches associated with these texts and examines some of their implications in the assessment of modern societies, their values, and institutional arrangements. Offers students an opportunity to develop the ability to critically reflect on the nature and scope of political discourse.

**POLS 2333. Politics and Film. (4 Hours)**

Analyzes interconnections between politics and film. Considering film as a political tool, includes such topics as political satire, propaganda, war, censorship, and nationalism. Case examples emphasize current events and contemporary issues.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**POLS 2345. Urban Policies and Politics. (4 Hours)**

Analyzes the political, administrative, economic, and social dynamics of urban areas. Highlights the diversity of political institutions and practices in American cities. Introduces key policy areas at the city level such as land use, economic development, and education.

**Prerequisite(s):** POLS 1150 with a minimum grade of D-

**POLS 2356. Democratic Erosion. (4 Hours)**

Presents the theoretical and empirical tools to critically and systematically address the urgent political question: Is democracy under threat in the United States and around the world, or are contemporary concerns about global democratic erosion overstated? By engaging in theories of democratic consolidation and backsliding, offers students an opportunity to build an understanding of the causes, symptoms, and consequences of democratic erosion. Examines a range of country cases in comparative perspective so that students can then evaluate the robustness of democratic institutions across regions including Eastern Europe, Latin America, and Sub-Saharan Africa, as well as the United States. Also explores the theme of democratic resilience by examining the case of India during the 1970s.

**Attribute(s):** NUpath Societies/Institutions

**POLS 2357. Growth and Decline of Cities and Suburbs. (4 Hours)**

Introduces students to the field of urban studies. Focuses on these central issues: how cities and suburbs evolve, what makes a city or suburb a good place to live, and how cities and suburbs are (or are not) planned. Students review the ways in which urban scholars and practitioners study cities and suburbs, their research methodologies, definition of issues, and division of labor among different disciplines. Students explore the roles of individuals, communities, the private sector, and government in planning and shaping the city.

**POLS 2358. Current Issues in Cities and Suburbs. (4 Hours)**

Introduces students to pressing urban issues: urban sprawl, poverty, education, transportation, economic development, and housing, through an intensive analysis of the Boston metropolitan area. The course is cotaught by university faculty and practitioners in government, community, and nonprofit organizations throughout the metropolitan area. Offers students the opportunity to analyze Boston data, go on outings to see development in progress, talk with urban practitioners about what they do, and conduct research on an urban issue of their choice.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**POLS 2359. Immigration Politics. (4 Hours)**

Offers an overview of immigration politics from a comparative perspective. Examines the history of immigration to the United States and Europe, focusing on migration, naturalization, assimilation, and integration policies. Details the political processes that have led to different policies over time and across countries.

**POLS 2368. Music and Politics in America and Abroad. (4 Hours)**

Explores the role of music in politics and the extent to which songs and their performers shape, frame, or otherwise influence political thought among audiences and listeners. Emphasizes contemporary themes and genres, with particular attention to protest songs. Examples are taken both from the United States and abroad.

**POLS 2370. Religion and Politics. (4 Hours)**

Explores the role of religion to domestic and international politics. Examines religion as a source of political tension and strife. Draws examples from the United States and the developing world. Covers Islamic fundamentalism in Africa and the Near East, Orthodox Jewish parties in Israel, Catholic liberation theology in Latin America, and Protestant fundamentalism and the religious right in the United States.

**Prerequisite(s):** POLS 1150 with a minimum grade of D- or POLS 1155 with a minimum grade of D- or INTL 1101 with a minimum grade of D-

**POLS 2378. Race and Ethnic Politics in the United States. (4 Hours)**

Explores how race and ethnicity influence American political institutions and the behaviors of their residents. Defines concepts like race and ethnicity and the impact that immigration has on diversifying the American polity. Investigates the three dominant ethno-racial minority groups (i.e., Black and African Americans, Asian Americans, and Latinos/as/x) and their political behaviors. Surveys topics such as the formation of partisan identification (i.e., Democrats and Republicans); political representation; policy preferences and public opinions; and mobilization and group-based participation.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**POLS 2390. Science, Technology, and Public Policy. (4 Hours)**

Considers the role of science and technology in the policymaking process, not only as a tool but also as a subject of policymaking. Cases include government involvement in innovation and economic growth, the role of the military in the development of science and technology, the governance and regulation of the effects of scientific and technological progress, public funding of science and technology, and ethical aspects of science and technology, including the emerging focus on anticipatory and participatory governance.

**POLS 2395. Environmental Politics and Policy. (4 Hours)**

Examines the political forces, governmental institutions, socioeconomic factors, and global trends that shape environmental policy at national and subnational levels in the United States. A spectrum of different environmental issues is discussed, with some comparison of policy activity in the U.S., other nations, and at the global level.

**Attribute(s):** NUpath Societies/Institutions

**POLS 2396. The Psychology of Misinformation. (4 Hours)**

Examines the psychological processes involved in the believing, sharing, and correcting of misinformation. Explores the cognitive and social factors that contribute to the spread of misinformation and its impact on individuals and society. Introduces methods of experiment design and opportunities to engage in experimental research for understanding misinformation.

**Attribute(s):** NUpath Societies/Institutions

**POLS 2399. Research Methods in Political Science. (4 Hours)**

Examines the range of research methods and designs used in political science, based on applying the logic of social scientific inquiry. Reviews experimental research, comparative methods, case studies, interviewing, surveys, program evaluation, and other topics relevant to the discipline, as well as questions related to the practice of research ethics. Course activities include intensive writing assignments by students. Requires prior completion of at least two of the following courses: POLS 1150, POLS 1155, and POLS 1160.

**Prerequisite(s):** ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**POLS 2400. Quantitative Techniques. (4 Hours)**

Studies methods of quantitative analysis including descriptive statistics, hypothesis testing, cross-tabulation, analysis of variance, bivariate regression and correlation, and multiple regression. Examines how to generate and interpret statistical findings through use of Excel, SPSS, and/or other software programs. Uses examples from political behavior, public policy analysis, public opinion, comparative and international politics, and other areas of political and social-science inquiry to emphasize practical applications.

**Prerequisite(s):** CS 1800 with a minimum grade of D- or MATH 1213 with a minimum grade of D- or MATH 1215 with a minimum grade of D- or MATH 1231 with a minimum grade of D- or MATH 1241 with a minimum grade of D- or MATH 1251 with a minimum grade of D- or MATH 1341 with a minimum grade of D- or MATH 1342 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**POLS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**POLS 2991. Research Practicum. (2-4 Hours)**

Involves students in collaborative research under the supervision of a faculty member. Offers students an opportunity to learn basic research methods in the discipline. Requires permission of instructor. May be repeated once for up to 4 total credits.

**POLS 3100. Gender, Social Justice, and Transnational Activism. (4 Hours)**

Introduces key issues, themes, and debates in feminist transnational theory, practice, and activism in contemporary contexts and how it has changed under socioeconomic, political, and cultural processes of globalization. Examines differences among women relating to race, class, sexuality, national identity, and political economy in reckoning with possibilities for sustainable social justice. Students interrogate the relationship between the local and global; the production of knowledge in different regional spaces; the pragmatics of political mobilization; the varying contours of "social justice"; and other key issues. Offers students an opportunity to discuss the impact of globalization, neoliberalism, and state and intimate violence on gendered politics and relations and to contend with the politics of difference, to debate its challenges, and to imagine possible futures for transnational gender justice.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**POLS 3160. Campaign Strategy. (4 Hours)**

Introduces students to the art of political campaigning in primary or general elections. Utilizes a case-study format to approach various aspects of campaign strategy by analyzing successful and unsuccessful campaigns.

**Prerequisite(s):** POLS 1150 with a minimum grade of D-

**POLS 3300. The U.S. Congress. (4 Hours)**

Explores the structures, dynamics, and styles inherent in public policymaking within the U.S. Congress. Focuses on elections; representations of constituents' interests; the roles that participants play: the president, interest groups, and others; and how all of this is affected by the structure of Congress and the process embedded in the legislative body.

**Prerequisite(s):** POLS 1150 with a minimum grade of D-

**POLS 3302. Judicial Process and Behavior. (4 Hours)**

Examines the nature of the judiciary in the United States. Focuses on courts and various aspects of the judicial process, including judicial selection, judicial decision making, the impact of judicial decisions on society, and public opinion of courts. After exploring, from various methodological perspectives, how and why courts behave as they do, the course turns its attention to questions about the role of courts in U.S. politics.

**Prerequisite(s):** POLS 1150 with a minimum grade of D-

**POLS 3304. Presidential Nominating Process. (4 Hours)**

Offers students an in-depth examination of the process the two major American parties use to nominate their presidential candidates. Major topics include the history and evolution of the presidential nomination process; the contemporary rules regime; the behavior of candidates, voters, and the media; vice presidential selection; the role of the national conventions; and prospects for reform. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** POLS 1150 with a minimum grade of D-

**POLS 3307. Public Policy and Administration. (4 Hours)**

Analyzes the structure of and dynamics inherent in public policymaking and public administration in the United States. Introduces such concepts as problem definition, agenda development, policy formation, program implementation, and policy evaluation. Covers key issues in public administration including budgeting, personnel, and organizational design.

**Prerequisite(s):** POLS 1150 with a minimum grade of D-

**POLS 3309. Lesbian, Gay, Bisexual, and Transgender Issues in Public Policy. (4 Hours)**

Examines the politics and public policies of the movement for equality and social justice for lesbian, gay, bisexual, and transgender (LGBT) people in a wide range of state and federal policy areas such as same-sex marriage, military service, family adoption rights, and employment discrimination protection. Reviews the political history of LGBT communities and the treatment of LGBT people since the 1920s in the United States and globally. Analyzes the policy debates by considering voting behavior, trends in public opinion toward LGBT issues, and the political incorporation of LGBT people in the United States and around the world. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** POLS 1150 with a minimum grade of D-

**POLS 3310. Public Opinion, Voting, and Elections. (4 Hours)**

Analyzes how Americans think about politics, how they vote, and how the rules of the U.S. electoral system affect electoral outcomes. Major topics include the nature and content of public opinion, mass partisanship, issues and issue voting, presidential and congressional elections, turnout and participation, campaign finance, and recent trends in U.S. electoral behavior.

**Prerequisite(s):** POLS 1150 with a minimum grade of D-

**POLS 3320. Politics and Mass Media. (4 Hours)**

Analyzes several facets of the mass media: the role of newspapers, radio, television, and the Internet in public opinion formation; their use and effectiveness in political campaigns; their objectivity and/or bias in reporting the news; and their impact on public policymaking.

**Prerequisite(s):** POLS 1150 with a minimum grade of D-

**POLS 3324. Law and Society. (4 Hours)**

Examines the sociological understanding of legal phenomena. Places special emphasis on the role of the law in cultural and social conflicts in American society.

**POLS 3405. International Political Economy. (4 Hours)**

Addresses international political economy and how we can understand the phenomenon of globalization. Introduces the interaction between international politics and international economics in industrial countries and in developing countries. Covers several theoretical approaches to international political economy. Then analyzes some of the classic issue areas of international trade relations; foreign direct investment and outsourcing; the international monetary and financial system and the role of international institutions; debt and financial crises; and poverty and inequality. Concludes with analysis of how international political economy issues relate to governance, development, and the politics of economic reform.

**Prerequisite(s):** POLS 1160 (may be taken concurrently) with a minimum grade of D-

**POLS 3406. International Law. (4 Hours)**

Introduces international law and how it redefines and shapes world politics. Offers students an opportunity to learn about the cornerstones of this area of the law: the state, organizations and their legal personality, diplomatic relations, treaties, extraterritorial jurisdiction, extradition, human rights and humanitarian law, the law of the sea trade/economic law, and international criminal law with a focus on the world courts. Considers the degree to which international law is pervasive in the life of individuals and states alike.

**Prerequisite(s):** POLS 1160 with a minimum grade of D-

**POLS 3418. Nationalism. (4 Hours)**

Explores contending theories of identity and nationalism—a powerful force in international and domestic politics. Examines topics such as the process of identity creation, the choice of national symbols, how group boundaries are established, the role of identity in conflict and state building, and the debate over nationalism's constructed or primordial nature. POLS 3418 and CLTR 3418 are cross-listed.

**Prerequisite(s):** POLS 1155 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**POLS 3420. U.S. National Security Policy. (4 Hours)**

Analyzes U.S. national security policy, with an emphasis on traditional and nontraditional threats, including threats from state and nonstate actors. Studies the national security policy process with special attention to developing countermeasures as well as resilience.

**Prerequisite(s):** POLS 1155 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**POLS 3423. Terrorism and Counterterrorism. (4 Hours)**

Examines some of the core debates over terrorism and counterterrorism. Topics include what constitutes terrorism, why people become terrorists, which targets they attack, whether nuclear terrorism is a serious threat, the extent to which terrorism helps the perpetrators, and their motives. From there, the course introduces the student to viable counterterrorism strategies. Permission of instructor required for students who do not meet prerequisite.

**Prerequisite(s):** POLS 1150 with a minimum grade of D- or POLS 1155 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**POLS 3425. U.S. Foreign Policy. (4 Hours)**

Examines the formulation and conduct of U.S. foreign and national security policy, with major emphasis on the period following the end of the Cold War.

**Prerequisite(s):** POLS 1150 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**POLS 3430. Revolution, Civil War, and Insurrection. (4 Hours)**

Explores various types of conflict settlements and their implications for peace and reconciliation. Why do civil wars break out in some places but not others? What does it take to start a revolution? Why do some conflicts last decades, and what can be done to mitigate their costs? Examines why civil conflicts begin, how they are fought, and how they end. Substantive topics include strategies of insurgency and counterinsurgency; the role of ethnicity, religion, and gender; and the relationship between economic factors and conflict. Students leverage fundamental concepts and theories in comparative politics to analyze civil conflicts in a wide range of country contexts.

**Prerequisite(s):** POLS 1160 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**POLS 3435. Politics and Governance of Europe and the European Union. (4 Hours)**

Examines contemporary political and governance issues in Europe and their impact on Europe's present and future. In addition to considering the values and institutions underlying the European Union's regional structure, including political, economic, military, social, monetary, and financial issues, the course also examines the issue of European identity and the impact of globalization on Europe.

**Prerequisite(s):** POLS 1155 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**POLS 3455. Russian Foreign Policy. (4 Hours)**

Presents an analysis of the goals, methods, and achievements of Russian policy in the post-Soviet era toward Eastern Europe, Western Europe, the Middle East, Central and East Asia, and the United States against the background of Soviet behavior toward these areas in the recent past.

**Prerequisite(s):** POLS 1155 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**POLS 3465. Government and Politics in the Middle East. (4 Hours)**

Examines political, economic, military, and ideological factors within the Arab states and Israel, inter-Arab politics, pan-Arabism, the Arab-Israeli conflict, and the great power rivalry in the region.

**Prerequisite(s):** POLS 1155 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**POLS 3470. Arab-Israeli Conflict. (4 Hours)**

Explores the history and politics of the Arab-Israeli conflict, examining the origins of the conflict, its development over time, the key events that have shaped it, and the different narratives and perceptions of these events. Offers students an opportunity to learn about the conflict from the emergence of Zionism and Arab nationalism up to present day. Emphasizes the Israeli-Palestinian dimension of the conflict.

**Prerequisite(s):** ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity

**POLS 3482. East Asian Politics. (4 Hours)**

Examines the politics of East Asian societies as they cope with a variety of challenges. Focuses on economic development, environment, energy, and security in Japan, China, and the Koreas.

**Prerequisite(s):** ASNS 1150 with a minimum grade of C or POLS 1155 with a minimum grade of C

**POLS 3485. China: Governance and Foreign Policy. (4 Hours)**

Focuses on China's political system and the major issues confronted: leadership recruitment and succession, economic policies and development, class and class struggle, political culture and socialization, human rights, civil society, the media, and both internal and external security concerns. Examines how ideology, development, culture, and the pursuit of China's national interest affect governance.

**Prerequisite(s):** POLS 1155 with a minimum grade of D-

**POLS 3487. Politics of Developing Nations. (4 Hours)**

Examines the political, governmental, social, economic, cultural, environmental, and geopolitical dimensions of change in nations regarded as "developing" by international standards. Covers a broad spectrum of types of nations including those in Eastern and Central Europe but pays particular attention to those in Asia, Africa, and Central and South America.

**Prerequisite(s):** POLS 1155 with a minimum grade of D- or INTL 1101 with a minimum grade of D-

**POLS 3500. Sexuality, Gender, and the Law. (4 Hours)**

Examines the legal regulation of gender and sexuality. Investigates concrete legal cases to study the history of constitutional interpretation and the current status of rights for women and sexual minorities. Focuses on important theoretical issues emerging in the writings of diverse feminist and queer legal scholars. Addresses debates over the value of conventional equality approaches in legal doctrine; equality vs. difference perspectives; ways in which legal language constructs gender and sexuality; the incorporation of sexuality and gender in ideologies of law; and the intersections of gender, sexuality, and race in legal doctrine and legal theory. PHIL 3500, POLS 3500, and WMNS 3500 are cross-listed.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**POLS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**POLS 4500. U.S. Constitutional Law. (4 Hours)**

Uses U.S. Supreme Court decisions and other reading materials to analyze theoretical, structural, and substantive issues inherent in, and relevant to, the American constitutional system.

**Prerequisite(s):** POLS 1150 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**POLS 4505. U.S. Civil Liberties. (4 Hours)**

Uses United States Supreme Court decisions and other reading material to examine the substantive and procedural guarantees of the Bill of Rights and the Fourteenth Amendment and their relation to a liberal democratic society.

**Prerequisite(s):** POLS 1150 with a minimum grade of D-

**POLS 4701. Political Science Senior Capstone. (4 Hours)**

Integrates and assesses the concepts and skills developed by students throughout the political science curriculum, including both experiential and classroom-based components. Requires extensive reflection by students on their various educational experiences as well as research projects involving individual and group presentations. Topics include contemporary political issues and relevant literature in the discipline of political science. Consideration is also given to career options for political science students. Required for political science majors and fulfills part of the experiential education requirement.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**POLS 4703. Senior Thesis. (4 Hours)**

Offers students an opportunity to conduct a significant research project under faculty supervision on a topic within the discipline of political science. Research question is formulated and analyzed through data gathering and a review of relevant literature in political science and related fields.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**POLS 4910. Model United Nations. (4 Hours)**

Introduces students to model simulations as a means of learning about international relations, diplomacy, and international organizations. Offers students an opportunity to conduct research and represent countries in current and historical simulations of the United Nations, U.N. organizations/agencies, regional international organizations, and joint cabinet crisis scenarios. Participating students have an opportunity to be selected for an off-campus competitive conference experience. May be repeated without limit.

**Attribute(s):** NUpath Difference/Diversity, NUpath Integration Experience

**POLS 4915. Model Arab League. (4 Hours)**

Offers students an opportunity to participate in teams that research assigned nations and represent those nations in a model Arab League role-playing exercise. Students may be selected to represent Northeastern University at the regional or national Model Arab League conferences in Washington, D.C., and different states. May be repeated twice.

**Attribute(s):** NUpath Integration Experience, NUpath Societies/Institutions

**POLS 4918. Model NATO. (4 Hours)**

Offers students an opportunity to participate in teams that research assigned nations and represent those nations in a model role-playing exercise of the North Atlantic Treaty Organization (NATO). Students may be selected to represent Northeastern University at the National Model NATO program in Washington, D.C. May be repeated up to two times.

**Attribute(s):** NUpath Integration Experience, NUpath Societies/Institutions

**POLS 4937. Dialogue of Civilizations: Government and Politics Abroad. (4 Hours)**

Examines government and politics in another country or region of the world through faculty-led travel to that country or region. Offers students an opportunity to enhance their knowledge of government and politics by attending and participating in various educational activities in the country of study. The course begins in the United States with an introduction to the country or region and concludes with activities that facilitate reflection and learning related to the experience abroad. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience, NUpath Societies/Institutions

**POLS 4938. Dialogue of Civilizations: International Politics Abroad. (4 Hours)**

Examines issues in international politics through faculty-led travel outside the United States. Offers students an opportunity to enhance their knowledge of international politics by attending and participating in various educational activities in another country. Course topics cover a range of interconnected global issues that go beyond states' borders, possibly including armed conflict, terrorism, organized crime, poverty, environmental degradation, the spread of nuclear weapons, and others. The course begins in the United States with an introduction to the relevant topics in international politics and concludes with activities that facilitate reflection and learning related to the experience abroad. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience, NUpath Societies/Institutions

**POLS 4942. Internship in Politics. (4 Hours)**

Gives students the opportunity to engage in a political or governmental internship under the supervision of a faculty member with departmental approval. Requires prior completion of 64 SH toward degree. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**POLS 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**Attribute(s):** NUpath Writing Intensive

**POLS 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** POLS 4970 with a minimum grade of D-

**POLS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**POLS 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated once.

**Attribute(s):** NUpath Integration Experience

**POLS 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**POLS 4996. Experiential Education Directed Study. (4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major. Restricted to those students who are using it to fulfill their experiential education requirement. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**POLS 5408. International Security. (4 Hours)**

Exposes students to the foundational and contemporary theories in international security and offers opportunities for application. Topics include the role of different actors and institutions; the evolution of the international system; conventional and nonconventional warfare, strategy, and tactics; and conflict negotiation. Addresses several issue areas in international security, including civil war, ethnic conflict, terrorism, civil-military relations, cybersecurity, and the role of gender.

**Prerequisite(s):** POLS 1160 with a minimum grade of D- or graduate program admission

**POLS 5976. Directed Study. (1-4 Hours)**

Offers assigned reading under the supervision of a faculty member. May be repeated without limit.

**POLS 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**POLS 6955. Co-op Work Experience Abroad - Half Time. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated without limit.

**POLS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**POLS 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated twice.

**POLS 6965. Co-op Work Experience Abroad. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated without limit.

**POLS 7204. Seminar in Public Policy. (4 Hours)**

Provides a comprehensive introduction to key theoretical perspectives in the study of public policy. Includes different perspectives on policy change, policy formation, policy design, and policy implementation. Seeks to prepare students to apply a policy theory to their own research question.

**POLS 7205. Seminar in American Government and Politics. (4 Hours)**

Focuses on major research approaches and corresponding academic literature in U.S. politics. Examines the scholarly analysis of key actors in U.S. politics, including the presidency, Congress, the judiciary, and political parties.

**POLS 7206. Seminar in Comparative Politics. (4 Hours)**

Focuses on major research paradigms within comparative politics, including political culture, structuralism, and rational choice. Examines major research fields in the discipline, including democratization, nationalism, ethnic politics, political economy, and political parties.

**POLS 7207. Seminar in International Relations. (4 Hours)**

Focuses on major research approaches and corresponding academic literature in international relations. Examines major fields of study, including international security, international regimes, international organizations, globalization, and international political economy.

**POLS 7255. American Political Parties and Elections. (4 Hours)**

Focuses on American political parties and includes analyses of party organizations and decision-making systems, leader/activist differences in policy and ideology, party reform, policy commitments, campaign finance, media, voting behavior, and an overview and assessment of contemporary elections and campaigns.

**POLS 7257. The U.S. Judicial Process. (4 Hours)**

Studies the judicial process in the United States, emphasizing federal courts. Focuses on theories and empirical research regarding judicial decision making, how and why judges decide what they do, and the resulting political effects.

**POLS 7282. Contemporary Political Thought. (4 Hours)**

Explores the main currents of political thought during the 20th century. Emphasizes the relations between political theory, philosophy, and political science.

**POLS 7325. Contemporary Issues in Third World Development. (4 Hours)**

Examines the major themes in development studies today. Explores approaches to the development and production, population growth, equity and poverty, rural and urban development, health and nutrition, education, and the international context of development assistance. Students considering a development administration concentration should try to take this course as their first in the field of development.

**POLS 7334. Social Networks. (4 Hours)**

Offers an overview of the literature on social networks, with literature from political science, sociology, economics, and physics. Analyzes the underlying topology of networks and how we visualize and analyze network data. Key topics include small-world literature and the spread of information and disease. Students who do not meet course prerequisites may seek permission of instructor.

**POLS 7341. Security and Resilience Policy. (4 Hours)**

Examines the post-9/11 evolution of security and the new emphasis on bolstering societal, infrastructure, system, and network resilience. Emphasizes the complex organizational; jurisdictional (international, federal, state, and local); private-sector; and civil-society issues associated with managing the risk of terrorism, cyber-attacks, and naturally occurring disasters. Topics include policy development and implementation of critical infrastructure protection, cybersecurity, supply chain security, disaster management, and community resilience.

**POLS 7343. Counterterrorism. (4 Hours)**

Examines the most important empirical and theoretical debates on counterterrorism. Analyzes the motives and strategies of key actors in the development of approaches to counterterrorism.

**POLS 7346. Resilient Cities. (4 Hours)**

Examines the characteristics of resilient cities, especially those located in coastal regions. Investigates the capacity of cities to respond to major disruptions to their social and ecological systems. Includes extensive use of case studies, such as the 2004 Indian Ocean tsunami and Hurricane Katrina in 2005, as well as readings on cities and social systems. Offers students an opportunity to analyze an urban area and provide recommendations for improving its resilience. POLS 7346 and PPUA 7346 are cross-listed.

**POLS 7366. Genocide in a Comparative Perspective. (4 Hours)**

Takes an interdisciplinary approach (that is, history, political science, and sociology) to the study of genocide. Examines the meaning of the concept in historical and philosophical terms, the societal and psychological causes of genocide, and specific cases throughout history, with emphasis on more recent episodes.

**POLS 7387. Global Governance. (4 Hours)**

Introduces the concept of global governance and the core architectural elements of the current system of global governance. Examines the key policy purposes and tasks carried out by global governance processes.

**POLS 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**POLS 7976. Directed Study. (1-4 Hours)**

Offers assigned reading under the supervision of a faculty member. May be repeated without limit.

**POLS 7980. Capstone Project. (4 Hours)**

Offers students an opportunity to complete a specialized research or applied project in political science or security studies as part of the master's degree. Designed to meet the specific learning and research interests of the student. Learning experience is based on activities that meet agreed-upon benchmarks with the instructor and may involve activities with government or nongovernment organizations.

**POLS 7983. Topical Seminar in Political Science. (4 Hours)**

Examines current issues in political science. May be repeated without limit.

**POLS 7990. Thesis. (4-8 Hours)**

Offers thesis supervision by individual members of the department. May be repeated without limit.

**POLS 8407. Internship. (4,8 Hours)**

Offers work experience (at least fifteen hours per week) that includes planning, research, policy development, and other administrative aspects in a government or nonprofit organization. May be repeated without limit.

**POLS 8960. Exam Preparation—Doctoral. (0 Hours)**

Offers the student the opportunity to prepare for the PhD qualifying exam under faculty supervision. May be repeated three times.

**POLS 8986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**POLS 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**POLS 9986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**POLS 9990. Dissertation Term 1. (0 Hours)**

Offers dissertation supervision by individual members of the department.

**Prerequisite(s):** POLS 9000 with a minimum grade of S

**POLS 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** POLS 9990 with a minimum grade of S

**POLS 9996. Dissertation Continuation. (0 Hours)**

Offers continued dissertation supervision by individual members of the department. May be repeated without limit.

**Prerequisite(s):** POLS 9991 with a minimum grade of S or Dissertation Check with a score of REQ

**Political Science - CPS (POL)**

**POL 1120. International Relations. (3 Hours)**

Introduces students to the core ideologies and methodologies of the study of international relations. Examines critical topics in international relations, such as war and diplomacy, international cooperation, and the nature of the international system. Emphasizes the nature of the international sphere and key topics currently affecting politics among states.

**Attribute(s):** NUpath Societies/Institutions

**POL 1200. Comparative Politics. (3 Hours)**

Introduces students to the comparative study of political organization and behavior in a variety of political systems present in a range of countries around the world. Examines different structures of political systems, governing institutions, leadership, political participation, major issues in political change, and sources of instability.

**Attribute(s):** NUpath Societies/Institutions

**POL 1300. American Government. (3 Hours)**

Introduces students to the American system of government, how it functions, and its politics. Studies early American history and philosophy as the source of the American Declaration of Independence, the design of the U.S. Constitution, and major issues in the development of the American political system. Examines the roles of public opinion, political behavior and participation, political parties, and interest groups in shaping American politics and policy. Includes a detailed analysis of major governmental institutions, their structures, and their operation.

**Attribute(s):** NUpath Societies/Institutions

**POL 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**POL 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**POL 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**POL 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**POL 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**POL 4996. Experiential Education Directed Study. (1-4 Hours)**

Draws upon the student's approved experiential activity and integrates it with study in the academic major.

**Attribute(s):** NUpath Integration Experience

**Political Science - CPS Specialty (PLSC)****PLSC 1420. Introduction to American Government. (4 Hours)**

Analyzes the system of politics and government in the United States. Topics include the philosophical basis, historical origins, design, and functioning of the Constitution as well as formal government institutions. Examines the influence of public opinion, political behavior and participation, parties, and interest groups.

**Portuguese (PORT)****PORT 1101. Elementary Portuguese 1. (4 Hours)**

Begins the integrated development of elementary language skills through cultural exploration. Includes class discussion and project-based learning. Offers students an opportunity to gain a deeper understanding of daily life, social norms, and family structure in Portuguese-speaking countries. Designed for students with very little or no prior knowledge of Portuguese.

**PORT 1102. Elementary Portuguese 2. (4 Hours)**

Builds on PORT 1101 and continues the integrated development of elementary language skills through cultural exploration. Includes class discussion and project-based learning. Offers students an opportunity to gain a deeper understanding of the linguistic, cultural, and geographic diversity of the Portuguese-speaking world.

**Prerequisite(s):** PORT 1101 with a minimum grade of C- or PORT 1301 with a minimum grade of C-

**PORT 1501. Accelerated Elementary Portuguese 1. (4 Hours)**

Introduces Portuguese to native/heritage speakers of Spanish, beginner-level heritage speakers of Portuguese, and students who have completed at least two levels of intermediate Spanish. Focuses on fundamental communication skills—speaking, aural comprehension, reading, and writing. Also explores cultural elements of the Portuguese-speaking countries. Students who do not have the preparation described may seek permission of instructor. This course is the equivalent of completing two semesters of elementary Portuguese.

**PORT 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PORT 2101. Intermediate Portuguese 1. (4 Hours)**

Builds on PORT 1102 and begins the integrated development of intermediate language skills through cultural exploration. Includes class discussion and project-based learning. Offers students an opportunity to gain a deeper understanding of the changes to modern life in Portuguese-speaking countries and efforts to face societal challenges.

**Prerequisite(s):** PORT 1102 with a minimum grade of C- or PORT 1302 with a minimum grade of C- or PORT 1501 with a minimum grade of C-

**PORT 2102. Intermediate Portuguese 2. (4 Hours)**

Builds on PORT 2101 and focuses on further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through written composition, prepared oral reports, and reading and discussion from contemporary Portuguese materials.

**Prerequisite(s):** (PORT 2101 with a minimum grade of C- or PORT 2301 with a minimum grade of C- )

**PORT 2900. Specialized Instruction in Portuguese. (1-4 Hours)**

Focuses on developing students' language proficiency and cultural competence within a specific context. May be repeated twice for a maximum of 12 semester hours with department approval.

**Prerequisite(s):** PORT 1102 with a minimum grade of C-

**PORT 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PORT 3101. Advanced Portuguese 1. (4 Hours)**

Continues further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through advanced reading, composition, grammar review, and listening skills. Whenever possible, offers students an opportunity to engage in local community activities to enhance communication skills and cultural knowledge.

**Prerequisite(s):** PORT 2102 with a minimum grade of C- or PORT 2302 with a minimum grade of C-

**PORT 3900. Specialized Instruction in Portuguese. (1-4 Hours)**

Focuses on developing students' language proficiency and cultural competence within a specific context. May be repeated twice for a maximum of 12 semester hours with department approval.

**Prerequisite(s):** PORT 2102 with a minimum grade of C-

**PORT 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PORT 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PORT 4992. Directed Study. (1-4 Hours)**

Offers students a way of going beyond work given in the regular curriculum; may also enable students to complete major or minor requirements in certain situations. Priority is given to language majors and to juniors and seniors. May be repeated without limit.

**PORT 5976. Directed Study. (1 Hour)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**Product Management - CPS (PDM)****PDM 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**PDM 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**PDM 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**PDM 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**PDM 6000. Foundations of Product Management. (3 Hours)**

Explores core concepts and frameworks of product management by utilizing strategic thinking and cross-functional collaboration. Covers the product development life cycle, market analysis, and stakeholder engagement through case studies and theoretical perspectives. Examines principles guiding product vision, prioritization, and execution across diverse industries. Offers foundational insights essential for navigating the dynamic landscape of product management. Focuses on adaptability and innovation.

**PDM 6940. Product Analytics. (1 Hour)**

Delves into the technical and analytical aspects of product management through experiential learning. Students engage in a real-world project, applying data analysis, assessing technical feasibility, and managing product life cycles. Emphasizes metric-driven decision making, requirements gathering, and agile methodologies. Offers students an opportunity to develop practical skills to bridge the gap between technical development and strategic objectives, preparing for the complex demands of product management roles.

**PDM 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**PDM 6980. Capstone. (3 Hours)**

Offers students an opportunity to synthesize and apply the knowledge and skills acquired throughout their studies in the master's program. Focuses on a comprehensive project that mirrors real-world product management challenges, from strategic planning and market analysis to product design, development, and launch. Requires students to employ critical thinking, cross-functional collaboration, and data-driven decision making across complex product initiatives.

**Prerequisite(s):** (ARTG 5600 with a minimum grade of C- ); (EMGT 6750 with a minimum grade of C- or PDM 6000 with a minimum grade of C- ); (INNO 6409 with a minimum grade of C- )

## Professional Studies - CPS (PST)

### PST 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions.

### PST 2990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions.

### PST 3990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions.

### PST 4990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions.

### PST 6962. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions.

### PST 7700. Introduction to Doctoral Studies. (3 Hours)

Explores the foundational aspects of doctoral-level research and scholarship. Covers the expectations of doctoral study including literature review techniques, critical analysis, scholarly writing, and research methodologies utilized in doctoral research across professional disciplines. Examines various theoretical frameworks and methodologies, ethical considerations, and a nuanced understanding of academic integrity and rigor. Emphasizes developing critical thinking skills and essential tools and perspectives necessary for advanced research in multiple disciplines.

### PST 7710. Thought Leadership, Innovation, Leading Change, and Policy. (3 Hours)

Explores concepts and strategic approaches to leading change, fostering innovation, shaping policy agendas, and navigating dynamic and complex organizational landscapes. Advanced topics include thought leadership's impact on policy formulation and transformative change, organizational dynamics, and strategic decision making.

**Prerequisite(s):** PST 7700 with a minimum grade of C-

### PST 7720. Introduction to Research and Research Design. (3 Hours)

Introduces fundamental concepts in research methodology, principles of research paradigms, theory, and quantitative and qualitative approaches. Emphasizes the essential skills for formulating research questions, selecting appropriate methods and approaches to collecting data, and understanding ethical considerations.

### PST 7730. Data Analysis for Professionals: Visualization and Interpretation. (3 Hours)

Presents data analysis techniques focused on the principles of data visualization and interpretation tailored for professionals across various disciplines. Offers students an opportunity to obtain hands-on experience in selecting and applying appropriate visualization tools to represent complex datasets effectively. Explores methodologies for interpreting visualizations and drawing meaningful insights to inform decision making. Emphasizes critical skills in data-driven storytelling and communicating findings to diverse stakeholders.

**Prerequisite(s):** PST 7720 with a minimum grade of C-

### PST 7740. Advanced Applied Research Methods. (3 Hours)

Explores advanced techniques in applied research methodologies. Emphasizes practical applications, complex research studies, statistical analyses, and interpreting findings in diverse contexts. Topics include experimental design, mixed methods, and innovative data collection techniques through qualitative and quantitative approaches. Offers insights on advanced research design, implementation, and ethical considerations in applied research settings.

**Prerequisite(s):** PST 7730 with a minimum grade of C-

**PST 7750. Product Development, Innovation, and Entrepreneurship. (3 Hours)**

Presents a comprehensive overview of product development, innovation, and entrepreneurship within diverse organizational contexts. Examines strategies for identifying market opportunities, conceptualizing and prototyping new products, and navigating the challenges of launching ventures. Analyzes case studies of successful startups and applies frameworks for assessing market viability, managing risks, and fostering a culture of innovation. Also discusses evaluating the role of emerging technologies and disruptive business models in shaping entrepreneurial landscapes.

**Prerequisite(s):** PST 7720 with a minimum grade of C-

**PST 7755. Advanced Quantitative Methods. (3 Hours)**

Presents advanced quantitative methods used in research and data analysis. Explores statistical software techniques and their application in interdisciplinary contexts, emphasizing critical thinking and practical data manipulation and interpretation. Topics include multivariate analysis, advanced regression models, experimental design, and data visualization.

**Prerequisite(s):** PST 7740 with a minimum grade of C-

**PST 7760. Dissertation Development, Research and Analysis, Presentation, and Discussion. (3 Hours)**

Offers students an opportunity for continued dissertation work conducted under the supervision of their faculty chair toward the completion of the doctoral degree.

**Prerequisite(s):** PST 7720 with a minimum grade of C-

**PST 7983. Topics. (3 Hours)**

Covers special topics in professional studies, emerging technologies, or industry advancements. Topics vary by semester. May be repeated once.

**Prerequisite(s):** PST 7740 with a minimum grade of C-

## Project Management - CPS (PJM)

**PJM 1100. Project Management Fundamentals - Project Initiation and Close. (3 Hours)**

Explores topics including project management principles, project phases, project domains, project management process groups, and roles of the project manager. Offers students an opportunity to work specifically with tools, techniques, and processes throughout project initiation and project close. Utilizes case studies and real-world examples to demonstrate the inner workings of a project.

**PJM 1400. Project Planning. (3 Hours)**

Introduces the tools, techniques, and processes applied in project scope management, estimating, scheduling and resource allocation, and control. Offers students an opportunity to build a detailed work plan and integrate best practices resulting in a resource-balanced, time-sensitive schedule and project plan. Introduces additional topics, including estimating and scheduling tools, applied to student work.

**Prerequisite(s):** PJM 1100 with a minimum grade of D-

**PJM 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PJM 2000. Project Monitoring and Control. (3 Hours)**

Explores the role of the project manager during project execution and the tools, techniques, and processes used to monitor and control the project. Offers students an opportunity to utilize project baselines to monitor progress, resolve issues, and manage changes. Applies analytics and earned value to determine the health of the project and identify and implement actions to continue, revise, or terminate the project. Addresses additional topics, including performance reporting and dashboards, to highlight best practices in providing project information to key stakeholders.

**Prerequisite(s):** PJM 1100 with a minimum grade of D- ; PJM 1400 with a minimum grade of D-

**PJM 2100. Quality and Risk. (3 Hours)**

Covers management planning, risk identification, risk analysis, risk response planning and implementation, and risk monitoring. Offers students an opportunity to work with quality management planning, quality assurance, and quality control tools and techniques to ensure the project solution meets the quality standards it is designed to achieve. The key to project success is to be prepared to address risk as well as ensure that the project solution is fit for use.

**Prerequisite(s):** PJM 1100 with a minimum grade of D- ; PJM 1400 with a minimum grade of D-

**PJM 2200. Project Procurement and Contract Management. (3 Hours)**

Offers an in-depth analysis of project procurement including resource identification (human, material, equipment); resource managing; control; and closing of procurement activities. Also covers key topics including how to work with different contract types and legal aspects of project management.

**Prerequisite(s):** PJM 1100 with a minimum grade of D- ; PJM 1400 with a minimum grade of D-

**PJM 3000. Leading Agile Projects. (3 Hours)**

Offers an overview of agile project methodologies. Introduces agile approaches, compares and contrasts these approaches to traditional project management, and considers how to tailor the two approaches to determine a project's best approach. Additionally, reviews agile-specific practices from an application perspective and investigates agile project management tools.

**Prerequisite(s):** (PJM 1100 with a minimum grade of D- ; PJM 1400 with a minimum grade of D- ) or ITC 4500 with a minimum grade of D-

**PJM 3100. Principles of Business Analysis Management. (3 Hours)**

Presents a framework of business analysis and requirements management. Topics include the role of the business analyst in the current organizational environment, understanding the business need, working with key stakeholders to identify the benefits of the project, and strategies to lead the organizational change necessary to harvest that value. Offers students an opportunity to utilize case studies to focus on process improvement and writing requirements.

**Prerequisite(s):** PJM 1100 with a minimum grade of D-

**PJM 4000. Program and Project Portfolio Management. (3 Hours)**

Offers an overview of program and project portfolio management. Explores the role of project, program, and project portfolio management in supporting realization of an organization's strategy. Projects may be subsets of a program—reviews the role of the program manager and tools, techniques, and processes used to plan and manage a program. Projects and programs are subsets of a portfolio—discusses how the portfolio is selected and managed. Reviews case studies, current articles, and readings to reinforce student learning.

**Prerequisite(s):** PJM 1100 with a minimum grade of D-

**PJM 4850. Capstone. (3 Hours)**

Offers students an opportunity to utilize all the project management tools, techniques, and skills they have acquired. Students explore the integration of the curriculum throughout the entire project life cycle, applying applicable integration concepts to achieve desired project outcomes. Reviews case studies, current articles, and readings to reinforce learning. This is the final course in the project management BS program.

**Prerequisite(s):** PJM 1100 with a minimum grade of D- ; PJM 1400 with a minimum grade of D- ; PJM 2000 with a minimum grade of D- ; PJM 2100 with a minimum grade of D- ; PJM 2200 with a minimum grade of D- ; PJM 3000 with a minimum grade of D- ; PJM 3100 with a minimum grade of D- ; PJM 4000 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PJM 5000. Project Management Practices. (2.25 Hours)**

Provides an overview of the project management process. Emphasizes project definition, identification of project scope, project life cycle, and project planning. Uses case studies to examine best practices and common project management pitfalls.

**PJM 5001. Foundations of Project Management. (3 Hours)**

Offers students an opportunity to learn foundational knowledge and concepts in project management. Analyzes various project management methodologies while presenting a structured approach to understanding key principles, models, and methods required to manage various project types through a complete project life cycle. Introduces project management software and emphasizes distinctions between project, program, and portfolio management. Strongly recommended for students with little or no formal project management experience.

**PJM 5005. Project Scope Management. (2.25 Hours)**

Offers insight into how projects are defined, evaluated, and ultimately translated into manageable project requirements and concrete deliverables. By learning how to identify stakeholder needs and convert those needs into viable, measurable project scope documentation, a project manager can successfully manage not only a project's scope but also make informed recommendations when trade-offs between project scope, cost, and schedule become necessary.

**PJM 5015. Project Risk Management. (2.25 Hours)**

Examines quantitative techniques for risk assessment and decision making, as well as the steps and elements of a risk management plan, including the ongoing monitoring of risk factors. The accurate identification of risks, and understanding of how to account for the potential impact of risks, can greatly impact the likelihood of project success.

**PJM 5025. Project Scheduling and Cost Planning. (2.25 Hours)**

Builds on the project schedule to explore cost estimation methods, break-even analysis, and earned value management. Studies effective tools and techniques that can allow project managers to translate specifications to realistic project plans that lead to a resource-loaded schedule and baseline budget. These tools and techniques can be used to minimize bottlenecks and downtime, identify and plan for resource needs, develop contingencies, and manage risk and scope creep. Topics include schedule development, cost estimating, and cost and schedule management through earned value management. A well-thought-out and well-managed schedule is critical to successful project management and is integral to the efficient management of project costs. Offers students an opportunity to learn to manage the project budget, revise cost estimates, and develop confidence levels.

**PJM 5075. Project Finance. (2.25 Hours)**

Explores real-world cases of project finance across industry sectors (e.g., energy, resource recovery, mining, and government infrastructure) to examine how organizations structure their capital to mitigate various project risks and to secure scarce resources for large-scale projects in the business environment. Topics include financial statements and ratio analysis, capital structure, discounted cash flow, financial instruments, capital budgeting, cost of capital, risk and return, procurement and project agreements, time value of money, and project investment ranking. Offers students an opportunity to develop a deep understanding of the principles of project finance.

**PJM 5135. Project Quality Management. (2.25 Hours)**

Designed to provide detailed instruction in Project Quality Management (PQM) processes, one of the ten knowledge areas outlined in the Project Management Institute's Project Management Body of Knowledge. Discusses how to integrate PQM processes into the overall project plan and how to prepare a PQM plan. Encourages students to work together in a team environment to complete a PQM plan for a project.

**PJM 5175. Project Resource Management. (2.25 Hours)**

Provides an overview of Procurement Management and Human Resource Management and how these two knowledge areas are key to a project's success. Learners have the opportunity to view through the lens of the project manager and procurement office the processes necessary to effectively purchase or acquire products, services, or results for a given project. Examines how to effectively acquire, develop, and manage human resources in various organizational settings.

**PJM 5205. Leading and Managing Technical Projects. (2.25 Hours)**

Offers students an opportunity to learn about leadership and management skills and strategies needed to succeed in a demanding technical project environment. Many project managers understand the technical aspects of a particular project environment but lack these critical management and leadership skills. Topics covered include understanding the technical environment, managing and motivating team members, understanding organizational culture, interpersonal strategies, and developing a personal leadership approach.

**PJM 5210. Communication Skills for Project Managers. (2.25 Hours)**

Offers students an opportunity to learn strategies for communicating technical concepts in a clear, concise, and appropriate manner for both written and oral communication media. In all project environments, communication is critical for project success. The ability to craft project reports and to communicate with customers, clients, team members, and company executives is critical for anyone leading technical projects. Often, the project manager needs to communicate technical data to a nontechnical audience. Explores various communication models and approaches with a focus on applying those models in a real-world context.

**PJM 5215. Leading Remote Project Teams. (2.25 Hours)**

Offers students an opportunity to learn strategies for creating a cohesive, high-performing project team in a remote project environment. The challenges of leading a remote project team are apparent to anyone who has attempted it. The technological challenges are complicated by the reality that most teams have participants located around the world. Therefore, we face not only the standard fare of interpersonal challenges but also cultural challenges as well.

**Prerequisite(s):** PJM 5001 with a minimum grade of D-

**PJM 5810. Principles of Agile Project Management. (2.25 Hours)**

Provides an overview of the fundamentals of agile project management. Topics include agile vs. traditional approaches, the agile manifesto, and the development of agile as a value-added business practice. Introduces key agile project management practices, including communication management planning and risk-management planning. Reviews agile-specific practices and method tailoring from an application perspective. Investigates agile project management tools.

**PJM 5820. Agile Implementation and Governance. (3 Hours)**

Explores the advantages and hurdles of implementing agile methodologies in organizations. Examines the essential aspects of adopting the agile approach at the enterprise level, agile governance, and strategies for implementing change. Further evaluates the application of various agile frameworks across different levels of organization, from team to group to enterprise. Studies the significance of agile culture, the pivotal roles of leadership and PMO in agile setups, the interplay of agile with other product/service delivery methodologies employed by organizations (e.g., DevOps), and the concept of agile fostering a resilient enterprise.

**PJM 5900. Foundations of Project Management. (4 Hours)**

Offers students an opportunity to learn foundational knowledge and concepts in project management. Analyzes various project management methodologies while presenting a structured approach to understanding key principles, models, and methods required to manage various project types through a complete project life cycle. Introduces project management software and emphasizes distinctions between project, program, and portfolio management. Strongly recommended for students with little or no formal project management experience.

**PJM 6000. Project Management Practices. (3 Hours)**

Provides an overview of the project management process. Emphasizes project definition, identification of project scope, project life cycle, and project planning. Uses case studies to examine best practices and common project management pitfalls.

**Prerequisite(s):** PJM 5900 with a minimum grade of C-

**PJM 6005. Project Scope Management. (3 Hours)**

Offers insight into how projects are defined, evaluated, and ultimately translated into manageable project requirements and concrete deliverables. By learning how to identify stakeholder needs and convert those needs into viable, measurable project scope documentation, a project manager can successfully manage not only a project's scope but also make informed recommendations when trade-offs between project scope, cost, and schedule become necessary.

**Prerequisite(s):** PJM 5900 with a minimum grade of C-

**PJM 6015. Project Risk Management. (3 Hours)**

Examines quantitative techniques for risk assessment and decision making, as well as the steps and elements of a risk management plan, including the ongoing monitoring of risk factors. The accurate identification of risks, and understanding of how to account for the potential impact of risks, can greatly impact the likelihood of project success.

**Prerequisite(s):** PJM 5900 with a minimum grade of C-

**PJM 6025. Project Scheduling and Cost Planning. (3 Hours)**

Builds on the project schedule to explore cost estimation methods, break-even analysis, and earned value management. Studies effective tools and techniques that can allow project managers to translate specifications to realistic project plans that lead to a resource-loaded schedule and baseline budget. These tools and techniques can be used to minimize bottlenecks and downtime, identify and plan for resource needs, develop contingencies, and manage risk and scope creep. Topics include schedule development, cost estimating, and cost and schedule management through earned value management. A well-thought-out and well-managed schedule is critical to successful project management and is integral to the efficient management of project costs. Offers students an opportunity to learn to manage the project budget, revise cost estimates, and develop confidence levels.

**Prerequisite(s):** PJM 5900 with a minimum grade of C- ; PJM 6005 (may be taken concurrently) with a minimum grade of C-

**PJM 6075. Project Finance. (3 Hours)**

Explores real-world cases of project finance across industry sectors (e.g., energy, resource recovery, and mining) to examine how organizations structure their capital to mitigate various project risks and to secure scarce resources in the business environment. Topics include capital structure, discounted cash flow, financial instruments, capital budgeting, cost of capital, risk and return, project agreements, project cost accumulation, project cost allocation, and project investment ranking. Offers students an opportunity to develop a profound understanding of the principles of project finance.

**Prerequisite(s):** PJM 6025 with a minimum grade of C-

**PJM 6100. Foundations of Project Management. (3 Hours)**

Studies foundational knowledge and concepts in modern project management. Presents insights into various project management methodologies while providing a structured approach to understanding key principles, models, methods, and processes required to manage various project types in the business environment. Introduces project management software programs. Emphasizes the practical application of project management tools to enhance efficiency and productivity. Strongly recommended for students with little or no formal project management experience.

**PJM 6120. Project Scope, Schedule, and Cost Management. (3 Hours)**

Integrates scope, schedule, and cost planning to offer students a deep dive into project definition, stakeholder needs assessment, cost estimation, and schedule development. Explores practical tools for translating needs into measurable project scope documents, creating resource-loaded schedules, managing trade-offs, and controlling scope creep. Emphasizes developing budget baselines, handling variances, managing project costs, and utilizing earned value analysis for cost and schedule oversight. Offers students an opportunity to obtain the skills to optimize project plans, manage bottlenecks, and establish contingencies, enhancing project management proficiency.

**Prerequisite(s):** PJM 6100 with a minimum grade of C-

**PJM 6125. Project Evaluation and Assessment. (3 Hours)**

Offers students an opportunity to learn to develop metrics for determining and reporting project performance. Examines both quantitative and qualitative approaches of evaluation, with an emphasis on earned value management. Examines stakeholder analysis and techniques for reporting performance results.

**Prerequisite(s):** PJM 5900 with a minimum grade of C-

**PJM 6135. Project Quality Management. (3 Hours)**

Introduces project quality management principles, processes, models, and methods necessary to deliver quality projects and products within organizations. Discusses how to integrate PQM processes into the overall project plan and how to prepare a PQM plan. Offers students an opportunity to work together in a team environment to complete a PQM plan for a project.

**Prerequisite(s):** PJM 5900 with a minimum grade of C-

**PJM 6140. Managing Troubled Projects. (3 Hours)**

Examines how to prevent failed and troubled projects, how to perform a project assessment/audit, how to develop a troubled project recovery plan, and how to develop a failed project shutdown plan. Includes team presentations of case study assignments to gain experience in managing and avoiding failed and troubled projects, one of the most significant assignments for a project manager.

**Prerequisite(s):** PJM 6005 with a minimum grade of C- ; PJM 6015 with a minimum grade of C- ; PJM 6025 with a minimum grade of C- ; PJM 6135 with a minimum grade of C-

**PJM 6145. Global Project Management. (3 Hours)**

Expands the detailed treatment of project management into the global areas of environmental factors, national differences, cultural differences, outsourcing, and virtual project management. The state of the art in project management has advanced to heavy use of global project management. Addresses the Project Management Institute's Project Management Body of Knowledge practices as applied in the organization and the future of project management.

**Prerequisite(s):** PJM 5900 with a minimum grade of C-

**PJM 6175. Project Resource Management. (3 Hours)**

Offers an overview of procurement management and human resource management and studies how these two knowledge areas are key to a project's success. Describes the processes necessary to effectively purchase or acquire products, services, or results for a given project through the lens of the project manager and procurement office. Examines how to effectively acquire, develop, and manage human resources in various organizational settings.

**PJM 6180. Project Stakeholder Management. (3 Hours)**

Offers students an opportunity to learn the mechanisms necessary to effectively identify all stakeholders, including the people, groups, or organizations that are impacted or may have an impact on the project. Examines how to analyze stakeholder expectations and how to develop management strategies for effective stakeholder engagement throughout the project.

**PJM 6185. Managing Innovation Projects. (3 Hours)**

Examines theories and practices in managing innovation projects, while emphasizing the project manager's role in product development, value proposition design, innovation experimentation, and business modeling. Offers students an opportunity to explore agile concepts in rapid prototyping and to develop skills in assessing innovations for feasibility, viability, desirability, and sustainability. Explores common impediments to innovation faced by project leaders.

**PJM 6190. Emerging Research in Project Management. (3 Hours)**

Introduces concepts related to research and analysis that are integral to scholarly learning. Also introduces research methods, along with their applications, benefits, challenges, and limitations in the context of conducting meaningful inquiry and research in project management. Offers students an opportunity to explore research design, data collection, and statistical and interpretive analysis by completing a research project under faculty supervision in which they examine a relevant problem of practice in project management, conduct a literature review, analyze data, and present their findings.

**Prerequisite(s):** PJM 5900 with a minimum grade of C-

**PJM 6200. Project Risk Management. (3 Hours)**

Explores project risk management in-depth. Emphasizes essential principles, models, methods, and processes for optimizing project outcomes. Introduces the power of quantitative risk assessment, informed decisions through evidence-based approaches, and probabilistic estimates. Provides hands-on experiences with practical risk analytics using state-of-the-art technology. Emphasizes crafting robust risk management plans that prioritize continuous risk monitoring and the proactive management of sustainability risks. Offers students an opportunity to learn how to navigate project uncertainties to increase the likelihood of project success.

**Prerequisite(s):** PJM 6100 with a minimum grade of C-

**PJM 6205. Leading and Managing Technical Projects. (3 Hours)**

Offers students an opportunity to learn about leadership and management skills and strategies needed to succeed in a demanding technical project environment. Many project managers understand the technical aspects of a particular project environment but lack these critical management and leadership skills. Topics covered include understanding the technical environment, managing and motivating team members, understanding organizational culture, interpersonal strategies, and developing a personal leadership approach.

**PJM 6210. Communication Skills for Project Managers. (3 Hours)**

Offers students an opportunity to learn strategies for communicating technical concepts in a clear, concise, and appropriate manner for both written and oral communication media. In all project environments, communication is critical for project success. The ability to craft project reports and to communicate with customers, clients, team members, and company executives is critical for anyone leading technical projects. Often, the project manager needs to communicate technical data to a nontechnical audience. Explores various communication models and approaches with a focus on applying those models in a real-world context.

**PJM 6215. Leading Remote Project Teams. (3 Hours)**

Offers students an opportunity to learn strategies for creating a cohesive, high-performing project team in a remote project environment. The challenges of leading a remote project team are apparent to anyone who has attempted it. The technological challenges are complicated by the reality that most teams have participants located around the world. Therefore, we face not only the standard fare of interpersonal challenges but also cultural challenges as well.

**PJM 6300. Project Quality Management. (3 Hours)**

Introduces project quality management principles, processes, models, and methods necessary to deliver quality projects and products within organizations. Discusses how to integrate PQM processes into the overall project plan and how to prepare a PQM plan. Offers students an opportunity to work together in a team environment to complete a PQM plan for a project. Topics include quality planning, quality assurance, quality control, statistical process control, process capability analysis, cost of quality, quality analytics, and quality management systems.

**Prerequisite(s):** PJM 6100 with a minimum grade of C-

**PJM 6610. Foundations of Project Business Analysis. (3 Hours)**

Offers a framework of business analysis. Topics include the role of the business analyst in the current organizational environment, understanding the business need, working with key stakeholders to identify the benefits of the project, and strategies to lead the organizational change necessary to harvest value.

**Prerequisite(s):** PJM 5900 with a minimum grade of C-

**PJM 6620. Strategy Analysis and Needs Assessment. (3 Hours)**

Focuses on investigating needs and defining change strategy through quantitative and qualitative data collection and analysis techniques. Examines the design of data collection instruments and varied elicitation techniques. Applies theories and practices in strategy analysis using design thinking, agile analysis, behavior change design, and business architecture. Uses practical case studies to apply strategy analysis and needs assessments within a project, program, product, and organizational context.

**Prerequisite(s):** PJM 6610 with a minimum grade of C or PJM 6710 with a minimum grade of C

**PJM 6630. Requirements Analysis and Design. (3 Hours)**

Introduces techniques in requirements analysis, management, and design definition. Applies practices in the elicitation, analysis, and documentation of functional, nonfunctional, transitory, business, and stakeholder requirements. Applies tools and techniques in specifying, modeling, and prioritizing requirements. Evaluates strategies for determining design options and recommending solutions.

**Prerequisite(s):** PJM 6610 with a minimum grade of C or PJM 6825 with a minimum grade of C

**PJM 6640. Leadership Strategies for the Business Analyst. (3 Hours)**

Introduces the techniques applied by the business analyst to work with stakeholders in the requirements process. Emphasizes the processes of facilitation, communication, problem solving, consensus building, and negotiation. A central part of the course requires students to participate in and evaluate facilitated simulations.

**Prerequisite(s):** PJM 6610 with a minimum grade of C

**PJM 6710. Introduction to Program and Portfolio Management. (3 Hours)**

Examines project, program, and portfolio management with a primary focus on the similarities and distinctions between program management and portfolio management. Offers students an opportunity to develop and evidence a foundational understanding of program and portfolio management and the critical role these play within today's global environment.

**Prerequisite(s):** PJM 6005 with a minimum grade of C- ; PJM 6015 with a minimum grade of C- ; PJM 6025 with a minimum grade of C-

**PJM 6810. Principles of Agile Project Management. (3 Hours)**

Provides an overview of the fundamentals of agile project management. Topics include agile vs. traditional approaches, the agile manifesto, and the development of agile as a value-added business practice. Introduces key agile project management practices, including communication management planning and risk-management planning. Reviews agile-specific practices and method tailoring from an application perspective. Investigates agile project management tools.

**PJM 6815. Advanced Agile Project Management. (3 Hours)**

Constitutes an advanced offering focusing on specific approaches to executing projects in an agile environment. Seeks to provide the student with a firm grounding and an applied, experiential understanding of specific agile approaches. Offers students an opportunity to engage in real-world-oriented case studies to evidence a strong understanding of the methodologies in a practical, experiential manner by planning and simulating an agile project using a methodology taught in the course.

**Prerequisite(s):** PJM 6810 with a minimum grade of C-

**PJM 6820. Agile Implementation and Governance. (3 Hours)**

Explores the implementation of agile within an organization and the governance structure to support agile projects. Studies the use of change management techniques to address stakeholder needs as the organization moves from a traditional to agile or blended approach to projects. Reviews and applies advanced topics in program/ portfolio management in agile environments. Offers students an opportunity to develop an implementation strategy and governance plan.

**Prerequisite(s):** PJM 6810 with a minimum grade of C-

**PJM 6825. Agile Lean Product Development. (3 Hours)**

Offers a practical overview of modern lean/agile product exposure based on contemporary industry practice. To win in today's competitive market requires giving your business the ability to deliver highly profitable products faster than the competition. Covers the complete life cycle of product management, from identifying customers and users through to sales, marketing, and managing teams. Covers how to minimize investment and output while maximizing the information discovered in order to support effective decision making.

**Prerequisite(s):** PJM 6810 (may be taken concurrently) with a minimum grade of C

**PJM 6910. Capstone. (3 Hours)**

Offers students an opportunity to utilize project management methodologies, principles, and tools acquired in the master's program to develop plans that address stakeholder needs across the project life cycle.

**Prerequisite(s):** PJM 5900 with a minimum grade of C- ; PJM 6005 with a minimum grade of C- ; PJM 6015 with a minimum grade of C- ; PJM 6025 with a minimum grade of C- ; PJM 6135 with a minimum grade of C-

**PJM 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PJM 6980. Capstone. (7 Hours)**

Covers the key elements of project management as defined by the "Guide to the Project Management Body of Knowledge." Offers students an opportunity to prepare individual sections of the plan (including a focus on stakeholder identification, scope, time, cost, quality, risk, communication, human resources, and procurement) and then integrate these sections; to review earlier sections as each new area is planned, revising them to coordinate with the recent added plans; to develop a change management plan to ensure that this integration and coordination is maintained throughout the project life cycle; and to conduct a "lessons learned" session and incorporate the suggestions from this review to improve and finalize their integrated plan.

**PJM 6983. Special Topics. (1-4 Hours)**

Covers special topics in project management. May be repeated four times for up to 20 semester hours.

**PJM 6995. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated up to five times.

**PJM 7100. Advanced Project Management Techniques and Methodologies. (3 Hours)**

Presents a comprehensive overview of project management techniques and methodologies essential for successful project leadership in dynamic environments. Emphasizes strategic planning, as well as project management procedures and processes. Analyzes complex project scenarios and applies advanced tools for decision making and problem solving. Topics include large-scale project management, project teams, governance, ethics, and sustainability practices.

**PJM 7110. Strategic Program and Project Portfolio Management. (3 Hours)**

Studies advanced techniques for measuring performance, driving innovation, and achieving strategic objectives at the program and portfolio levels. Offers students an opportunity to explore complex methodologies for optimizing program delivery and portfolio alignment within organizational objectives. Topics include advanced risk management, strategic resource allocation, stakeholder engagement, governance frameworks, and decision making related to program and portfolio contexts.

**PJM 7130. Emerging Technologies in Project Management. (3 Hours)**

Explores innovative technologies revolutionizing project management in today's dynamic business landscape. Analyzes emerging technologies reshaping project execution and delivery while navigating ethical considerations and implementation challenges associated with integrating these technologies into project management practices. Topics cover innovations like AI-driven project analytics and risk assessment, IoT, blockchain, and cloud computing. Requires foundational project management knowledge.

**Psychology (PSYC)****PSYC 1000. Psychology at Northeastern. (1 Hour)**

Introduces students to the major and to the professional and academic resources available to students at Northeastern University. Introduces students to their faculty, advisors, and fellow students; educates students about the cooperative education program; familiarizes students with undergraduate research and technological resources; and introduces problem-solving and leadership skills, which students need to succeed in school and in their professional endeavors. Students who do not meet course prerequisites may seek permission of instructor.

**PSYC 1101. Foundations of Psychology. (4 Hours)**

Surveys the fundamental principles, concepts, and issues in the major areas of basic and applied psychological science. Approaches the study of psychology as a method of inquiry as well as a body of knowledge. Introduces students to research methods and to psychological research on the biological bases of behavior, learning, sensation and perception, cognition and language, development, emotion, social psychology, personality, and psychological disorders.

**Attribute(s):** NUpath Natural/Designed World, NUpath Societies/Institutions

**PSYC 1208. Psychology and the Law. (4 Hours)**

Introduces the range of topics that are of concern both to psychologists and to members of the legal profession. Covers the legal and ethical issues inherent in the conduct and process of professional psychology. Topics include confidentiality, ethical competence, duty to warn, expert testimony, malpractice, and forensic matters, such as the insanity defense. Discusses professional practice issues revolving around ethical concerns as they relate to specific weekly topics. Specifically, discusses five ethical theories (egoism, utilitarianism, deontology, care ethics, virtue ethics) used in case analysis. Examines the role of ethical theory as it applies to the expert's self-interest and personal position, positive and negative consequences for the defendant and society at large, psychologist expert duties to themselves, and conflicts. Designed to help students think about the legal system and its role in society today through a psychological lens.

**Attribute(s):** NUpath Ethical Reasoning

**PSYC 1210. Sports Psychology. (4 Hours)**

Studies the physical, affective, and cognitive behaviors associated with sport participation and also examines the psychological theories and research related to sport and exercise behavior. Introduces students to the field of sport and exercise psychology by providing a broad overview of the major topics in the area, including the history of sport and exercise psychology, leadership, self-confidence, youth sports, aggression, moral development, team dynamics, anxiety and arousal, goal setting, imagery, and motivation. Covers the psychological makeup of athletes, how psychological factors influence involvement and performance in sport, and helps students acquire the skills and knowledge about sport and exercise psychology that they can apply to their everyday lives.

**PSYC 1214. The Moral Mind: The Science Underlying Ethical Decision-Making and Virtuous Character. (4 Hours)**

Offers a scientific lens through which to analyze the mental mechanisms and processes that guide moral and ethical decision making. Although the majority of the evidence and perspectives covered stem from psychological and neuroscientific work, the course is interdisciplinary in nature by incorporating relevant perspectives from behavioral economics, evolutionary biology, and philosophy. The primary goal is to offer insight, not only into how the human mind automatically parses ethical issues in given situations but also how control can be gained over such mechanisms, thereby allowing greater efficacy in guiding morality according to consciously embraced principles.

**Attribute(s):** NUpath Ethical Reasoning

**PSYC 1250. Drugs and Behavior. (4 Hours)**

Offers beginning students a general overview of the effects of drug use/abuse in many segments of society with particular attention placed on the collegiate population. Describes historical aspects of drug use for treatments of clinical disease states along with psychological theories of drug abuse and strategies for prevention of drug use/abuse. Covers biological effects emanating from several drug categories and the clinical use of drugs to promote positive therapeutic outcomes.

**Attribute(s):** NUpath Natural/Designed World

**PSYC 1300. Emotion. (4 Hours)**

Examines the empirical findings, theoretical approaches, and laboratory methods in the science of emotion. Emotion is integral to nearly every part of society, including legal and economic matters, health, and social relationships. But do we truly understand what emotions are and how they work? Offers students an opportunity to practice evaluating claims about emotion made in the popular press, to develop skills in communicating information in science effectively, and to examine the process by which scientists determine whether and how emotion plays a role in a wide range of phenomena (e.g., sports psychology, health, artificial intelligence, etc.).

**PSYC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PSYC 2101. Love and Hate: Social, Psychological, and Literary Approaches. (4 Hours)**

Studies materials that define and describe love and hate from the fields of literature and literary criticism, social psychology, and criminology and criminal justice. "Love" and "hate" are small words describing powerful emotions with profound effects on individuals and on social groups. Focusing largely on contemporary examples, offers students an opportunity to analyze the differences and areas of overlap in the above fields' approaches to love and hate, to discuss societal responses to these emotions, and to apply the methodologies of each field to research questions of their own. INSH 2101 and PSYC 2101 are cross-listed.

**Prerequisite(s):** ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**PSYC 2315. Statistics in Psychological Research Supplement. (1 Hour)**

Covers basic principles of statistical analysis of research data, including descriptive statistics, probability, and hypothesis testing. Supplements AP statistics with more advanced statistical methods and the use of statistical software packages, including analysis of variance and the use of SPSS, which are foundational tools in psychological research but are not covered in the AP statistics curriculum.

**PSYC 2320. Statistics in Psychological Research. (4 Hours)**

Offers an overview of descriptive and inferential statistics with a focus on psychological applications. Covers standard material in undergraduate statistics including distributions, central tendency, variability, z-scores, the normal distributions, correlation, regression, probability, hypothesis testing (using the z, t, F, and chi-square statistics), and confidence intervals. Should be taken before the end of the sophomore year.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**PSYC 2370. Cross-Cultural Psychology. (4 Hours)**

Introduces students to the role of culture in psychological science. Discusses the relationship of culture to psychological theories and research. Investigates psychological research in WEIRD (western, educated, industrialized, rich, democratic) populations compared to those less frequently studied. Demonstrates possible psychological universals while accounting for cultural influences on psychology and behavior. Critically considers theoretical and methodological issues, accurate interpretation of cross-cultural findings, and practical applications.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**PSYC 2396. The Psychology of Misinformation. (4 Hours)**

Examines the psychological processes involved in the believing, sharing, and correcting of misinformation. Explores the cognitive and social factors that contribute to the spread of misinformation and its impact on individuals and society. Introduces methods of experiment design and opportunities to engage in experimental research for understanding misinformation.

**Attribute(s):** NUpath Societies/Institutions

**PSYC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PSYC 2991. Research in Psychology. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated seven times.

**PSYC 3200. Clinical Neuroanatomy. (4 Hours)**

Introduces students to the structure and function of the central nervous system (CNS) from spinal cord to cerebral cortex by using lesions of the human nervous system as a tool to reinforce and amplify learning of the structure and organization of the CNS. Assumes no prior knowledge of brain structures and begins with basic vocabulary, including directions, planes of dissection, and parts of brain cells. Seeks to provide the necessary anatomical foundation for further study in psychology and the neurosciences.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D- or PSYC 2290 with a minimum grade of D-

**PSYC 3400. Personality. (4 Hours)**

Offers a systematic study of the normal personality and its development. Focuses on behavioral, dynamic, social, and cognitive determinants, assessment of personality, and current research topics; surveys the major theories of personality.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**PSYC 3402. Social Psychology. (4 Hours)**

Provides an introductory survey of social psychology. Topics include aggression, attribution, attitude formation; and change, attraction, gender and culture, conformity, impression formation, and group processes.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**PSYC 3404. Developmental Psychology. (4 Hours)**

Examines change throughout the life span in social relationships, emotional functioning, language, cognition, and other psychological domains, with emphasis on infancy through adolescence. Introduces major theories of development. Stresses the interaction of social and cognitive factors in development, and the interaction of the developing person with the environment. Also explores individual and cross-cultural differences in patterns of development, and research issues in developmental psychology.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**PSYC 3406. Clinical Psychology and Mental Health. (4 Hours)**

Addresses diagnosis, theoretical perspectives, anxiety, and defense mechanisms. Examines the symptomatology, etiology, and treatment of a number of disorders including anxiety, dissociative, somatoform, affective (depression, mania), and schizophrenic disorders.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**PSYC 3450. Learning and Motivation. (4 Hours)**

Offers an introduction to the basic learning and motivational principles that permit humans and animals to adapt effectively to a changing environment. Emphasizes research and theories of operant and Pavlovian conditioning, with discussions of discriminations and generalization, avoidance and punishment, acquired motivational states (for example, addiction), concept formation, biological constraints on learning and behavior, animal cognition, and other related topics. Relates learning and motivational principles to the understanding and treatment of behavioral, affective, cognitive, and motivational disorders.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**PSYC 3451. Learning Principles and Behavior Analysis. (4 Hours)**

Introduces the basic concepts and theories of applied behavior analysis as they relate to learning and motivation. Topics include operant and classical conditioning, reinforcement, punishment, extinction, discrimination training, stimulus control, concept formation, and generalization. Throughout the course, offers students an opportunity to apply these principles to learning that occurs in their everyday lives as well as in the lives of individuals with developmental disabilities and other learning disorders.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**PSYC 3452. Sensation and Perception. (4 Hours)**

Discusses how our five senses work to aid us in perceiving states of the body and of the world, how our perceptions are modified by what we know and expect, and how sensation and perception develop (especially in infancy). Includes discussion of neural and anatomical bases of sensation and perception. PSYC 3458 is highly recommended.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**PSYC 3458. Biological Psychology. (4 Hours)**

Focuses on the relation between brain function and human behavior. Examines how nerve cells function individually and work together both in small networks and in the nervous system; the structure of the nervous system; how our sense organs provide the nervous system with information about the outside world; how the brain controls movement; and how psychological concepts from motivation to language and memory are represented in the brain.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**PSYC 3464. Psychology of Language. (4 Hours)**

Provides a basic introduction to psycholinguistics. Topics include the nature and structure of languages, processes involved in the production and comprehension of language, the biological bases of language, and aspects of language acquisition. Examines current theories of language processing and related experimental findings.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**PSYC 3466. Cognition. (4 Hours)**

Provides a basic introduction to human cognition. Topics include pattern recognition, attention, memory, categorization and concept formation, problem solving, and aspects of cognitive development. Examines current theories of cognitive processing and related experimental findings.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**PSYC 3506. Neuropsychology of Fear. (4 Hours)**

Explores our understanding of the physiological and cognitive aspects of fear, from early theories of emotion to current research in both humans and animal models. Emphasizes linking brain structure to function—how do different brain regions contribute to fear processing and expression? Also focuses on psychiatric illnesses whose symptoms suggest a maladaptive fear response, such as post-traumatic stress disorder and phobias. What causes these illnesses, and how does our understanding of the neural basis of fear inform our treatment strategies for these disorders? Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** BIOL 3405 with a minimum grade of D- or PSYC 3458 with a minimum grade of D-

**PSYC 3508. Behavioral Endocrinology. (4 Hours)**

Presents an overview of the field of behavioral endocrinology from a psychological perspective. Examines how hormones influence brain structure and function; how hormones affect behavior and vice versa; sex differences in brain and behavior; and the role of hormones in mood disorders, cognition, and stress.

**Prerequisite(s):** BIOL 3405 with a minimum grade of D- or PSYC 3458 with a minimum grade of D-

**PSYC 3510. Brain, Behavior, and Immunity. (4 Hours)**

Explores how our behavior is affected by (and how it affects) our immune system. The brain and the immune system regulate our behavioral responses to the world around us, which helps explain why we feel “down” when we’re sick and why we often catch a cold when we’re stressed. Offers students an opportunity to better understand how we have evolved to psychologically adapt to environmental challenges—and, importantly, how this can sometimes backfire with mental illness as an outcome. Students who do not meet course prerequisites may seek permission of instructor.

**Prerequisite(s):** BIOL 3405 with a minimum grade of D- or PSYC 3458 with a minimum grade of D-

**PSYC 3520. Child Intervention and Treatment. (4 Hours)**

Compares and contrasts primary, secondary, and tertiary levels of intervention as they pertain to child welfare systems. Topics include child development, impacts of poverty on development, child maltreatment, educational inequality, disability, play, and community violence. Examines the availability, distribution, effectiveness, and efficiency of universal targeted interventions in the home, school, and community. Offers students an opportunity to study current events, case studies, and documentaries as sources to connect social and psychological theory, research, and promising practices in child development.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**PSYC 3540. Environmental Psychology. (4 Hours)**

Incorporates themes from cognitive psychology and environmental science to examine how people understand the environment and their place in it and how this understanding varies with culture, informal experience, and formal education. Examines relations between environmental cognition, environmental attitudes, values and norms, and sustainable behavior.

**Prerequisite(s):** ENVR 1101 with a minimum grade of D- or ENVR 1400 with a minimum grade of D- or PSYC 1101 with a minimum grade of D-

**PSYC 3545. Ethics in Animal Research. (4 Hours)**

Addresses ethical considerations for the treatment of animals in psychological research. Presents a comprehensive overview of animal ethical treatment policies at research institutes as well as animal research laboratory trainings and qualifications. Explores historical and current perspectives on animal healthcare and well-being, and discusses alternatives to animal research.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**PSYC 3973. Special Topics in Psychology. (4 Hours)**

Examines selected topics in psychology. Topics vary each semester. May be repeated once.

**Prerequisite(s):** PSYC 1101 with a minimum grade of D-

**PSYC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PSYC 4505. Industrial/Organizational Psychology. (4 Hours)**

Surveys the psychological fundamentals underlying performance in work settings. Topics include psychological testing; performance evaluation; training, motivating, and leading employees; and the social psychology of organizations. Emphasizes ethical and affirmative action issues.

**Prerequisite(s):** PSYC 3402 with a minimum grade of D-

**PSYC 4510. Psychopharmacology. (4 Hours)**

Examines interactions between drugs, brain, and behavior. Focuses on such topics as synaptic transmission, behavioral functions of specific neurotransmitter systems, pharmacological treatment of mental and neurological disorders, and drug abuse.

**Prerequisite(s):** BIOL 3405 with a minimum grade of D- or PSYC 3458 with a minimum grade of D-

**PSYC 4512. Neuropsychology. (4 Hours)**

Examines the behavior of neurological patients and normal patients to develop an understanding of how the human brain works to produce higher mental functions. Topics include discussions of brain scans, human neuroanatomy, cerebral lateralization, language, memory, neurological disorders, and neural plasticity and recovery of function.

**Prerequisite(s):** BIOL 3405 with a minimum grade of D- or PSYC 3458 with a minimum grade of D-

**PSYC 4514. Clinical Neuroscience. (4 Hours)**

Explores the neurobiological, genetic, and neurochemical etiology of mental illness as described and categorized according to the DSM. Discusses how psychology, neuroscience, pharmacology, and medicine come together to manage mental illness. Investigates, for each specific mental illness covered, how changes in physiology and biology might manifest in the aberrant behaviors that define psychopathology. Lastly, examines how pharmacology is often used to treat these various mental illnesses and how genetic expression is involved in predisposing some people to these disorders while sparing others.

**Prerequisite(s):** BIOL 3405 with a minimum grade of D- or PSYC 3458 with a minimum grade of D-

**PSYC 4522. Psychology of Reading. (4 Hours)**

Provides an overview of issues in the psychology of reading. Topics include the nature of the reading process as a perceptual and cognitive activity, eye movement patterns in reading, stages of reading development, and dyslexia. Examines current theories of reading and text comprehension.

**Prerequisite(s):** PSYC 3464 with a minimum grade of D- or PSYC 3466 with a minimum grade of D-

**PSYC 4540. Quantitative Topics in Psychology and Behavioral Neuroscience. (4 Hours)**

Surveys key quantitative topics in psychology and behavioral neuroscience. Emphasizes theory and modeling, not statistics. Specific topics vary, but all are drawn from domains in which mathematics and computation play a significant role. Topics may include Fourier analysis with applications to vision and hearing, neural circuit computation, signal detection theory applied to human and nonhuman animals' decisions, measurement of sensory magnitudes in vision and hearing, the linear algebraic theory of color matching in humans, and analysis and models of human response time. Students complete weekly readings and a final project, typically involving use of software for data analysis.

**Prerequisite(s):** (MATH 1341 with a minimum grade of D- or MATH 1241 with a minimum grade of D- or MATH 1251 with a minimum grade of D-); (PSYC 2320 with a minimum grade of D- or MATH 3081 with a minimum grade of D-); (BIOL 3405 with a minimum grade of D- or PSYC 3452 with a minimum grade of D- or PSYC 3458 with a minimum grade of D- or PSYC 3464 with a minimum grade of D- or PSYC 3466 with a minimum grade of D-)

**PSYC 4570. Behavioral Genetics. (4 Hours)**

Explores the genetic basis of behavior. Behavioral genetics is considered to lie at the intersection of psychology and genetics and is a dynamic field with plenty of possibility. Offers students an opportunity to hone and develop a stronger foundation in the principles of Mendelian, population, and quantitative genetics. Studies the genetic basis for sleep, social behavior, responses to environmental stimuli, learning, memory, addiction, and the etiology of neuropsychiatric disorders.

**Prerequisite(s):** BIOL 2301 with a minimum grade of D- ; (BIOL 3405 with a minimum grade of D- or PSYC 3458 with a minimum grade of D- )

**PSYC 4600. Laboratory in Research Design. (4 Hours)**

Addresses the theoretical concepts, design, execution, analysis, and communication of research in psychology. Provides students with various methods to acquire hands-on experience performing a research project of their own creation. Students move systematically through the research process, from refining their original idea in the context of existing literature to interpreting and communicating their results. Requires prior completion of research-area course.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**PSYC 4604. Laboratory in Learning and Motivation. (4 Hours)**

Gives students the opportunity to gain proficiency, through direct experience, in lab analysis of behavior and in evaluating common generalizations about human behavior. Students design and perform experiments in animal and human learning, memory, decision processes, concept formation, and other topics of individual interest.

**Prerequisite(s):** (ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1114 with a minimum grade of C ); (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (PSYC 3450 with a minimum grade of D- or PSYC 3451 with a minimum grade of D- )

**Attribute(s):** NUpath Writing Intensive

**PSYC 4606. Laboratory in Biological Psychology. (4 Hours)**

Introduces the methods of research in psychobiology. Students work in small groups, conducting three to four hands-on laboratory exercises under supervised conditions. Students read selections of the relevant scientific literature, analyze the collected data, and write experimental reports.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); PSYC 3458 with a minimum grade of D- ; (ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**PSYC 4610. Laboratory in Psycholinguistics. (4 Hours)**

Provides students the opportunity to acquire firsthand experience in conducting research on issues in the psychology of language. Focuses on experiments and their implications for broader issues of language processing. Involves students in all aspects of each experiment including collecting and analyzing data and preparing lab reports.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (PSYC 3464 with a minimum grade of D- or PSYC 3466 with a minimum grade of D- ); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**PSYC 4612. Laboratory in Cognition. (4 Hours)**

Provides students the opportunity to acquire firsthand experience in conducting research on issues in human cognition. Focuses on experiments and their implications for broader issues of cognitive functioning. Involves students in all aspects of each experiment including collecting and analyzing data and preparing lab reports.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (PSYC 3464 with a minimum grade of D- or PSYC 3466 with a minimum grade of D- ); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**PSYC 4614. Laboratory in Social Psychology. (4 Hours)**

Provides an introduction to the methods of social-psychological research. Assists students in developing the ability to read published social research with a critical eye, to pose questions in a testable manner, to apply experimental methods to social research, and to express themselves in APA journal style.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); PSYC 3402 with a minimum grade of D- ; (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**PSYC 4616. Laboratory in Personality. (4 Hours)**

Provides an introduction to the methods and areas of personality research. Discusses problems of measurement, control, and interpretation. Critically examines representative published experiments. Students design, collect data for, assess, and write up several experiments.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); PSYC 3400 with a minimum grade of D- ; (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**PSYC 4622. Laboratory in Sensation and Perception. (4 Hours)**

Focuses on experiments using psychophysical methods in the various senses, typically including audition, vision, and others. Students collect data on themselves, analyze the data statistically, and write reports. Critical thinking is stressed.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); PSYC 3452 with a minimum grade of D- ; (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**PSYC 4624. Laboratory in Affective Science. (4 Hours)**

Provides instruction in the methods of affective science (i.e., the study of what emotions are and how they work). Students are expected to become members of a functioning lab team, which uses a multimethod approach combined with various theoretical frameworks to guide research in affective science. Offers students an opportunity to develop the ability to read the scientific literature; think critically about research questions; design, conduct, and analyze experiments; and write in APA journal style, as well as to gain valuable interpersonal and organizational skills that come from working on a team.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**PSYC 4626. Laboratory in Life-Span Emotional Development. (4 Hours)**

Studies life-span development and how emotional experience, perception, and regulation changes across the life span. Lab teams use a multimethod approach and theoretical frameworks to guide research in emotional development. Offers students an opportunity to learn how to read the scientific literature; think critically about research questions; design, conduct, and analyze experiments; write in the journal style of the American Psychological Association; and gain interpersonal and organizational skills while working on a research team. PSYC 3402 highly recommended.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**PSYC 4628. Laboratory in Developmental Psychology. (4 Hours)**

Offers students an opportunity to acquire firsthand experience in conducting research on issues in human development. Focuses on experimental and observational research across the life span. Involves students in all aspects of each research project, including designing original research, collecting and analyzing data, preparing lab reports, and presenting findings.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (PSYC 3404 with a minimum grade of D- or PSYC 4524 with a minimum grade of D- ); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**PSYC 4632. Laboratory in Psychophysiology. (4 Hours)**

Introduces the principles and practice of psychophysiology. Psychophysiology is an interdisciplinary science that uses biological measures, typically those recorded via sensors on or imaging of the body, where the scientific goal is to understand psychological processes, psychological principles, or the effects of psychological interventions. Combines learning about the basic methods of psychophysiology (with an emphasis on peripheral psychophysiology), the principles underlying these methods, scientific evidence, and the current scientific questions that psychophysiological methods are used to answer.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**PSYC 4656. Seminar in Biological Psychology. (4 Hours)**

Offers intensive study, discussion, and practice in lab studies of physiological variables. Covers evolution of the nervous system, neurological disorders, motivation and emotion, sleep, attention and perception, learning, and memory.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); PSYC 3458 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PSYC 4658. Seminar in Psycholinguistics. (4 Hours)**

Offers intensive study and discussion of issues in the psychology of language. Specific topics vary by semester.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (PSYC 3464 with a minimum grade of D- or PSYC 3466 with a minimum grade of D- )

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PSYC 4660. Seminar in Cognition. (4 Hours)**

Offers intensive study and discussion of issues in cognitive psychology. Specific topics vary by semester.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (PSYC 3464 with a minimum grade of D- or PSYC 3466 with a minimum grade of D- )

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PSYC 4662. Seminar in Personality. (4 Hours)**

Offers intensive study and discussion of issues in personality psychology. Allows students to examine selected topics and present their findings in class.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); PSYC 3400 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PSYC 4664. Seminar in Social Psychology. (4 Hours)**

Provides an in-depth analysis of specific topics in social psychology. Students read original research and theory papers involving these topics, make presentations, and write papers related to their readings.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); PSYC 3402 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PSYC 4666. Seminar in Clinical Psychology. (4 Hours)**

Focuses on psychotherapy: theory, methods, and outcome research. Provides an overview of clinical psychology: history, ethical and legal issues, the therapeutic relationship, cross-cultural counseling, the process of change. Students write and present papers on a topic of interest.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); PSYC 3406 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PSYC 4668. Seminar in Sensation and Perception. (4 Hours)**

Expects students to present in class on topics such as how perceptions are organized, formed, and modified by sensory, attentional, motivational, and cognitive factors, how our sensory systems extract information from the environment in a consistent and logical manner, despite large changes in environmental conditions, and how to account for this in physiological terms.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); PSYC 3452 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PSYC 4674. Seminar in Cognitive Neuroscience. (4 Hours)**

Offers intensive study and discussion of issues in cognitive neuroscience: the study of human cognitive processes, and their underlying neural substrates. Considers both theoretical and methodological issues, as well as applications to related fields of study. Specific topics vary by semester.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (PSYC 3464 with a minimum grade of D- or PSYC 3466 with a minimum grade of D- )

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PSYC 4676. Seminar in Developmental Psychology. (4 Hours)**

Offers intensive study and discussion of issues in developmental psychology, the study of how social, emotional, cognitive, and other psychological processes emerge and change over different periods of the life span. Considers both theoretical and methodological issues, as well as applications to real-world contexts. Specific topics may vary by semester.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); PSYC 3404 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PSYC 4678. Seminar in Social and Affective Neuroscience. (4 Hours)**

Addresses fundamental questions about mind-brain mapping (e.g., distributed vs. modular processing, predictive coding, sensory integration, etc.), with a focus on social and affective processing. Offers intensive study and discusses issues in social and affective neuroscience. Considers both theoretical and methodological issues, as well as applications to real-world contexts. Specific topics may vary by semester.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (PSYC 3400 with a minimum grade of D- or PSYC 3402 with a minimum grade of D- or PSYC 3404 with a minimum grade of D- or PSYC 3406 with a minimum grade of D- ); (PSYC 3450 with a minimum grade of D- or PSYC 3451 with a minimum grade of D- or PSYC 3452 with a minimum grade of D- or PSYC 3458 with a minimum grade of D- or PSYC 3464 with a minimum grade of D- or PSYC 3466 with a minimum grade of D- )

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PSYC 4682. Seminar in Learning and Motivation. (4 Hours)**

Offers intensive study and discussion of issues in learning and motivation. Examines behavioral mechanisms and cognitive processes that influence learning and performance. Considers both theoretical and methodological issues, as well as applications to real-world contexts such as psychology's educationally relevant science of how people learn. Explores how humans (and animals) make relatively permanent changes to their thinking and behavior, based on experience, to adapt to environmental demands and why people vary in the amount of time, energy, and talent they invest in the tasks they confront. Specific topics may vary by semester.

**Prerequisite(s):** (ENVR 2500 with a minimum grade of D- or MGSC 2301 with a minimum grade of D- or PSYC 2315 with a minimum grade of D- or PSYC 2320 with a minimum grade of D- ); (PSYC 3450 with a minimum grade of D- or PSYC 3451 with a minimum grade of D- )

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PSYC 4965. Undergraduate Teaching Experience. (4 Hours)**

Offers undergraduate teaching assistantships in psychology courses under the close direction of the course instructor. Assignments may include holding office hours and recitation/tutorial and review sessions, answering students' emails, moderating discussion boards, helping to proctor exams and quizzes, (very) limited lecturing, or leading class discussions (only under faculty supervision). Requires minimum overall GPA of 3.333, and grade of A- or higher in the course for which the student will be an undergraduate teaching assistant; permission to enroll is further subject to the availability of an appropriate course assignment and instructor; prior arrangements must be made with the instructor at least one term before registration. May be repeated once, but may not be repeated for the same course.

**Attribute(s):** NUpath Integration Experience

**PSYC 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**PSYC 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Prerequisite(s):** PSYC 4970 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Integration Experience, NUpath Writing Intensive

**PSYC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PSYC 4991. Directed Study Research. (4 Hours)**

Offers research experience on a chosen topic under the direction of a faculty member. Research content and requisites depend on the instructor. Prior arrangements must be made with the faculty member at least one term before registration. May be repeated up to three times.

**Attribute(s):** NUpath Integration Experience

**PSYC 4994. Internship in Psychology. (4 Hours)**

Offers supervised experiences in the application of psychology in instructional, clinical, or other applied settings. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**PSYC 5110. Cognitive Science. (3 Hours)**

Serves as a first-level graduate course in cognitive sciences, focusing on theoretical, experimental, and methodological issues. Presents the foundation of terminology, theoretical questions, and research skills in brain and cognition to support future study. Introduces strategies for reading, evaluating, and discussing papers dealing with the brain and cognition. Provides a working vocabulary of cognitive neuroscience approaches and neuroanatomy, along with tools for honing knowledge to match specific research interests. Requires permission of instructor for students who are not enrolled in the PhD program in psychology.

**PSYC 5115. Colloquium. (3 Hours)**

Aims to prepare students to be active and informed participants in presented talks from invited speakers from across a wide breadth of psychology and behavioral neuroscience fields. Requires participation in weekly departmental seminars. Faculty members who host weekly visiting seminar speakers lead students in discussions about each upcoming speaker to foster critical thinking about each research topic and to prepare questions and ideas for the invited speaker. Covers topics related to giving a successful scientific talk and communicating science in general. No writing component. May be repeated once.

**PSYC 5120. Proseminar in Sensation. (3 Hours)**

Serves as first-level graduate course in sensation, focusing on theoretical, experimental, and methodological issues. Includes faculty lectures, student presentations, and discussion. Requires permission of instructor for students who are not enrolled in the PhD program in psychology. May be repeated without limit.

**PSYC 5130. Proseminar in Perception. (3 Hours)**

Serves as first-level graduate course in perception, focusing on theoretical, experimental, and methodological issues. Includes faculty lectures, student presentations, and discussion. Requires permission of instructor for students who are not enrolled in the PhD program in psychology. May be repeated without limit.

**PSYC 5140. Proseminar in Biology of Behavior. (3 Hours)**

Serves as first-level graduate course in the biological basis of behavior, focusing on theoretical, experimental, and methodological issues. Includes faculty lectures, student presentations, and discussion. Requires permission of instructor for students who are not enrolled in the PhD program in psychology. May be repeated without limit.

**PSYC 5150. Proseminar in Clinical Neuroscience. (3 Hours)**

Serves as first-level graduate course in clinical neuroscience, focusing on theoretical, experimental, and methodological issues. Includes faculty lectures, student presentations, and discussion. Requires permission of instructor for students who are not enrolled in the PhD program in psychology. May be repeated without limit.

**PSYC 5170. Social and Affective Science. (3 Hours)**

Serves as a first-level graduate course in social and affective sciences. Focuses on theoretical, experimental, and methodological issues. Includes faculty lectures, student presentations, and discussion. Requires permission of instructor for students who are not enrolled in the PhD program in psychology.

**PSYC 5180. Quantitative Methods 1. (3 Hours)**

Presents first course in a two-course sequence that surveys a variety of quantitative methods used in experimental psychology. Requires permission of instructor for students who are not enrolled in the PhD program in psychology.

**PSYC 5181. Quantitative Methods 2. (3 Hours)**

Continues PSYC 5180. Presents second course in a two-course sequence that surveys a variety of quantitative methods used in experimental psychology. Requires permission of instructor for students who are not enrolled in the PhD program in psychology.

**Prerequisite(s):** PSYC 5180 with a minimum grade of C- or PSYC 5180 with a minimum grade of D-

**PSYC 5301. Research Methods in Psychological Sciences. (3 Hours)**

Offers students an opportunity to obtain an in-depth understanding of one of various clinical and preclinical methods in neuroscience, psychophysiology, and psychology, with the focus alternating with the expertise of each instructor. Pairs hands-on learning with group discussions and presentations. Studies EEG, fMRI, computational modeling, neurobiological assays, animal behavioral assays, and psychophysics. May be repeated once.

**PSYC 5410. Human Behavior and Sustainability. (3 Hours)**

Offers a graduate-level introduction to the interdisciplinary field of human behavior and sustainability sciences. Explores an emerging literature embracing the complexity of social-ecological systems to better engage with the processes that reinforce unsustainable pathways and those that might be leveraged toward more sustainable futures. Focuses on understanding how observations about the psychology of individuals and collectives, and their relationship to institutions, have been theorized in relation to the environment and the approaches and methodologies used to test and describe such relationships.

**PSYC 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PSYC 7250. Seminar in Clinical Neuroscience. (3 Hours)**

Addresses current theoretical and empirical issues in clinical neuroscience. Specific topics vary by semester. May be repeated thrice.

**PSYC 7300. Advanced Quantitative Analysis. (3 Hours)**

Covers selected advanced methods of quantitative analysis used in experimental psychology. Specific topics vary by semester. May be repeated without limit.

**PSYC 7301. Research Methodologies Psychology. (3 Hours)**

Introduces students to a range of conceptual and methodological issues in the conduct of experimental psychology research by department faculty members. Specific course content depends on which faculty members conduct the course in a given semester. May be repeated without limit.

**PSYC 7302. Ethics and Professional Issues. (3 Hours)**

Identifies and investigates ethical issues (such as privacy, fairness, social responsibility, or animal use) that research psychologists face in acquiring and using scientific knowledge. Also addresses broader professional issues relevant to pursuing a career as a research psychologist in an academic, government, or industrial setting.

**PSYC 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**PSYC 7990. Thesis. (3 Hours)**

Conducts theoretical and experimental research for the master's degree. May be repeated without limit.

**PSYC 7996. Thesis Continuation - Half-Time. (0 Hours)**

Continues research for the master's degree.

**PSYC 8401. Research Project. (3 Hours)**

Conducts research project in selected area of experimental psychology. May be repeated without limit.

**PSYC 8402. Special Topics in Psychology. (3 Hours)**

Offers in-depth analysis of critical topics in psychology. Specific topics vary by semester. May be repeated without limit.

**PSYC 8410. Special Topics in Human Behavior and Sustainability. (3 Hours)**

Offers in-depth analysis of critical topics in human behavior and sustainability sciences. Specific topics vary by semester. May be repeated up to five times for a maximum of 18 semester hours.

**PSYC 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**PSYC 9986. Research. (0 Hours)**

Offers the student the opportunity to conduct doctoral research. May be repeated without limit.

**PSYC 9990. Dissertation Term 1. (0 Hours)**

Conducts theoretical and experimental research for the PhD degree.

**Prerequisite(s):** PSYC 9000 with a minimum grade of S

**PSYC 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** PSYC 9990 with a minimum grade of S

**PSYC 9996. Dissertation Continuation. (0 Hours)**

Continues research for the PhD degree.

**Prerequisite(s):** PSYC 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Psychology - CPS (PSY)

**PSY 1050. Introduction to Behavioral Health Science Professions. (3 Hours)**

Introduces students to the major and to the landscape of behavioral health professions. Offers students an opportunity to consider their professional track and to begin formulating goals. Acclimates students to the Northeastern network, including how to access the professional, interpersonal, and academic resources available. Introduces students to their faculty advisors and fellow students and describes available experiential learning opportunities. Familiarizes students with undergraduate research and technological resources. Introduces the mindsets, dispositions, and competencies to support academic, professional, and personal sustainability.

**PSY 1100. Foundations of Psychology. (3 Hours)**

Surveys the fundamental principles, concepts, and issues in the major areas of contemporary scientific psychology. Approaches the study of psychology as a method of inquiry as well as a body of knowledge. Offers students an opportunity to obtain a basis for more advanced study of the science of psychology. Examines origins and methods of psychology, including neuroscience, consciousness, cognition, development, nature and nurture debate, psychosocial development, learning and memory, language, motivation, personality, group dynamics, therapy, health psychology, and psychological disorders.

**Attribute(s):** NUpath Natural/Designed World

**PSY 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PSY 2110. Principles of Human Learning. (3 Hours)**

Presents the basic learning principles that permit humans to adapt effectively to a changing environment. Covers the science of how humans learn and the research and techniques of classical and operant conditioning with discussions of discrimination and generalization, biological constraints on learning, and other related topics. Relates learning principles to the understanding and treatment of behavioral, affective, cognitive, and motivational disorders.

**Prerequisite(s):** PSY 1100 with a minimum grade of D-

**PSY 2230. Stress, Resilience, and Behavior Change. (3 Hours)**

Offers a research-experiential approach to understanding the benefits and negative consequences of stress and its effects on human behavior and physiology. Discusses the work of researchers and practitioners in stress response. Topics include the relation of stress to health, communication, relationships, and academic and work performance. Examines the behavioral strategies associated with leveraging the stress response in personal and professional arenas. Considers perspectives of resilience, coping, and behavioral change from various social and cultural standpoints.

**PSY 2240. Human Sexuality and Love. (3 Hours)**

Focuses on the historical, biological, psychological, developmental, and social/cultural influences on human sexuality and its expression. Sexuality lies at the core of our identities as human beings, yet many adults are uninformed of basic aspects of sexual anatomy and function. Topics include sexual anatomy and physiology, contraception and abortion, pregnancy and childbirth, gender identity, role and expression, romantic love, sexual minorities, media impact on sexuality, and attitudes toward contemporary issues.

**PSY 2300. Human Behavior and Decision Making. (4 Hours)**

Introduces learners to fundamentals of individual reasoning and decision making. Begins by introducing underlying factors that influence decision making, such as personality, emotions and emotional intelligence, perception, and attribution. Explores the impact of situational variables on human behavior and decision making. Applies these concepts to the study of human logic, decision-making processes, and common decision-making biases. Addresses the role of these topics in enabling organizational resilience.

**PSY 2500. Applied Behavior Analysis 1. (3 Hours)**

Focuses on how to facilitate significant behavior change in applied settings using foundational principles of behavior analysis to spur on effective, meaningful, and ethical change. Applied behavior analysis is a discipline that strives to understand and improve human behavior. Covers how to choose, identify, and effectively employ reinforcers, foundations of behavior assessment, and development of function-based interventions.

**PSY 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PSY 3150. The Opioid Crisis. (3 Hours)**

Focuses on the complexities of addiction across the life span, including the associated biological, psychological, and social factors. The exorbitant rise in rates of opioid addiction and overdoses world-wide require effective, evidence-based interventions to support the millions of individuals, families, communities, and societies affected. Examines the continuum of care model including promotion, prevention, treatment, and recovery. Topics include key risk and protective factors; co-occurring disorders; and evidence-based practices and methods of engaging diverse constituents through outreach, education, service delivery, capacity building, and systems change.

**Prerequisite(s):** PSY 1100 with a minimum grade of D-

**PSY 3200. Social Psychology. (3 Hours)**

Surveys the socialization process, including social motives, interpersonal perception, group membership and structure, gender and culture, attitudes, prejudice, and leadership. Social psychology is embedded in our professional and personal roles. Identifies key theories and frameworks to apply in today's work and living arenas.

**Prerequisite(s):** PSY 1100 with a minimum grade of D- or SOC 1100 with a minimum grade of D- or (PSY 1010 with a minimum grade of D- ; PSY 1210 with a minimum grade of D- ) or (PSY 1010 with a minimum grade of D- ; PSY 1410 with a minimum grade of D- ) or (PSY 1210 with a minimum grade of D- ; PSY 1410 with a minimum grade of D- )

**PSY 3210. Abnormal Psychology. (3 Hours)**

Covers diagnosis, symptomatology, etiology, and therapy of anxiety, somatoform, and dissociative disorders. Introduces the major forms of psychotherapy, including psychoanalysis and client-centered, behavioral, and cognitive therapy.

**Prerequisite(s):** PSY 1100 with a minimum grade of D- or (PSY 1010 with a minimum grade of D- ; PSY 1210 with a minimum grade of D- ) or (PSY 1010 with a minimum grade of D- ; PSY 1410 with a minimum grade of D- ) or (PSY 1210 with a minimum grade of D- ; PSY 1410 with a minimum grade of D- )

**PSY 3220. Cognition and Language. (3 Hours)**

Offers an in-depth analysis of human cognition and language. Topics include pattern recognition, attention, memory, categorization and concept formation, problem solving, and aspects of cognitive development. Examines current theories of cognitive processing and related experimental findings. Introduces psycholinguistics, the nature and structure of language, its biological bases, acquisition, production, and perception.

**Prerequisite(s):** PSY 1100 with a minimum grade of D- or (PSY 1010 with a minimum grade of D- ; PSY 1210 with a minimum grade of D- ) or (PSY 1010 with a minimum grade of D- ; PSY 1410 with a minimum grade of D- ) or (PSY 1210 with a minimum grade of D- ; PSY 1410 with a minimum grade of D- )

**PSY 3230. Development across the Life Span. (3 Hours)**

Explores change throughout the life span. Focuses on the basic physical, perceptual, cognitive, and emotional capacities that develop from infancy through late adulthood. Emphasizes how biological inheritance interacts with the physical and social environment. Explores individual and cross-cultural differences in patterns of development.

**Prerequisite(s):** PSY 1100 with a minimum grade of D- or (PSY 1010 with a minimum grade of D- ; PSY 1210 with a minimum grade of D- ) or (PSY 1010 with a minimum grade of D- ; PSY 1410 with a minimum grade of D- ) or (PSY 1210 with a minimum grade of D- ; PSY 1410 with a minimum grade of D- )

**PSY 3240. Sensation and Perception. (3 Hours)**

Examines how our sensory organs—eyes, ears, skin, mouth, and nose—along with our sensory nervous system inform our awareness of the outside world and influence our internal perceptual world. Covers perception of light, space, form, motion, color, attention, speech, and music. Topics include visual and auditory perception, neural and anatomical bases, and early and ongoing influences on development of sensation and perception.

**Prerequisite(s):** PSY 1100 with a minimum grade of D- or (PSY 1010 with a minimum grade of D- ; PSY 1210 with a minimum grade of D- ) or (PSY 1010 with a minimum grade of D- ; PSY 1410 with a minimum grade of D- ) or (PSY 1210 with a minimum grade of D- ; PSY 1410 with a minimum grade of D- )

**PSY 3330. Autism Spectrum Disorders. (3 Hours)**

Focuses on the characteristics, theory, and teaching and intervention applications for individuals with autism spectrum disorders (ASD). Discusses approaches, trends, and etiological and diagnostic issues. By embracing an inclusionary, strengths-based approach, educational and behavioral professionals are better able to engage families through responsive instructional and intervention strategies across the life span.

**Prerequisite(s):** PSY 1100 with a minimum grade of D- ; PSY 2500 with a minimum grade of D-

**PSY 3450. Research in Psychology. (3 Hours)**

Explores research methods in psychology including observational, correlational, survey, and experimental methods. Uses the scientific method in the design, execution, analysis, and communication of psychological investigations. Discusses the ethics of research and evaluation methods. Offers students an opportunity to conduct psychological studies using a variety of methods and to write a substantial research paper.

**Prerequisite(s):** (MTH 2300 with a minimum grade of D- or MTH 2310 with a minimum grade of D- or MTH 3300 with a minimum grade of D- ); PSY 3200 with a minimum grade of D-

**Attribute(s):** NUpath Writing Intensive

**PSY 3500. Applied Behavior Analysis 2. (3 Hours)**

Builds upon the basic principles of applied behavior analysis presented in PSY 2500. Focuses on the necessary structures to build effective instruction and intervention for a wide range of clinical and school settings. Allows for varied applications for clients and students with addiction, developmental disabilities, autism, and related disabilities, as well as learning disabilities.

**Prerequisite(s):** PSY 2500 with a minimum grade of D-

**PSY 3700. Behavior Measurement. (3 Hours)**

Explores principles of quantitative behavior analysis with an emphasis on applying research to practice. Analyzing data and embarking upon experiential design are vital components of intervening with populations. Employs a variety of methods to explore different methodologies in behavior analysis in accordance with the current Behavior Analyst Certification Board task list.

**Prerequisite(s):** PSY 1100 with a minimum grade of D- ; PSY 3500 with a minimum grade of D-

**PSY 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PSY 4230. Physiological Psychology. (3 Hours)**

Explores the relationship between brain function and human behavior. Introduces how nerve cells function. Topics include localization of function in the brain, perception, learning, eating behavior, motivation, and the relation of emotion to nervous system activity.

**Prerequisite(s):** PSY 3230 with a minimum grade of D- or (PSY 3420 with a minimum grade of D- ; PSY 3421 with a minimum grade of D- ) or (PSY 3420 with a minimum grade of D- ; PSY 3422 with a minimum grade of D- ) or (PSY 3421 with a minimum grade of D- ; PSY 3422 with a minimum grade of D- )

**PSY 4310. Personality. (3 Hours)**

Focuses on behavioral, dynamic, and constitutional determinants. Includes concepts such as environmental and genetic contributions, assessment of personality, research, and a survey of the major personality theories.

**Prerequisite(s):** PSY 1100 with a minimum grade of D-

**PSY 4400. Behavior Assessment and Evaluation. (3 Hours)**

Explores the methods used to identify, measure, and assess the behaviors of individuals using applied behavior analysis (ABA), including behaviors targeted for increase and decrease. In-depth topics include function-based assessment and treatment in behavior analysis; design and details of the assessment process, including selection of an appropriate assessment method; and the methodology, results, and recommendations derived from a functional behavior assessment. Explores assessments such as the DIBELS, ABLLS-R, and VB-MAPP, along with widely used instruments. The capacity to effectively analyze behavior and develop appropriate intervention strategies to bring about behavioral change is a fundamental competency for professionals.

**Prerequisite(s):** PSY 3500 (may be taken concurrently) with a minimum grade of D-

**PSY 4600. Advanced Practicum 1. (3 Hours)**

Offers students an opportunity to apply behavioral principles and methods within organizational settings. Students engage in agency settings to bolster and demonstrate professional competencies needed to serve individuals, groups, organizations, and communities in our global 21st century.

**Prerequisite(s):** PSY 1100 with a minimum grade of D-

**PSY 4850. Senior Research Seminar in Psychology. (3 Hours)**

Offers students an opportunity to independently investigate a topic of interest and present their findings to their peers. This capstone course for the undergraduate curriculum should be taken as close as possible to graduation.

**Prerequisite(s):** PSY 3450 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**PSY 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**PSY 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Public Health (PHTH)****PHTH 1260. The American Healthcare System. (4 Hours)**

Introduces the organization and dynamics of the healthcare system and the role of consumers. Explores basic elements of healthcare including financing, personal insurance, high-risk status, and patient rights within the context of the U.S. system. Central to this exploration is an analysis of healthcare issues requiring informed consent from patients: patient bill of rights, healthcare directives, and the use of a proxy for decision making. Introduces the roles and responsibilities of various healthcare workers within the framework of an interdisciplinary model of healthcare.

**Attribute(s):** NUpath Societies/Institutions

**PHTH 1261. Comparative Healthcare Systems. (4 Hours)**

Designed to enable health profession students to develop a basic understanding of health-delivery systems and key issues confronting healthcare in the United States and in the study country in this study-abroad course. Explores issues such as the affordability of medical care, patient rights, health risks and behaviors, disease prevention, quality and access to care, the growth of managed care and corporate influence on healthcare, new medical technologies, the aging population, the impact of biotechnology, and trends in employment of health professionals. Incorporates self- and group-reflection exercises, Internet and contemporary media exploration, and in-class discussions. Compares and contrasts key healthcare issues in the study country with those in the United States using literature, Internet and contemporary media, observations in the study country, and discussions with guest speakers.

**Attribute(s):** NUpath Societies/Institutions

**PHTH 1270. Introduction to Global Health. (4 Hours)**

Introduces global health in the context of an interdependent and globalized world focusing on four main areas of analysis: infrastructure of global health; diseases; populations; and terms, concepts, and theories. While the focus is on lower-income countries, the course examines issues in a broader global context, underscoring the interconnections between global health disparities and global health policy response. Applies case studies describing interventions to improve healthcare in resource-poor settings in sub-Saharan Africa and elsewhere to help illuminate the actors, diseases, populations, and principles and frameworks for the design of effective global health interventions. AFRS 1270 and PHTH 1270 are cross-listed.

**Attribute(s):** NUpath Societies/Institutions

**PHTH 2210. Foundations of Biostatistics. (4 Hours)**

Introduces the fundamental concepts of biostatistics. Offers students an opportunity to learn to apply statistical thinking to practical problems across several health disciplines. Draws examples and readings from clinical and public health literature. Introduces R programming language.

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Formal/Quant Reasoning

**PHTH 2300. Communication Skills for the Health Professions. (4 Hours)**

Offers students in the health professions an opportunity to learn how to communicate effectively with patients, colleagues, and other professionals. Covers interpersonal communication with patients and families from culturally diverse backgrounds, public speaking and presentations, and communicating as a leader. Requires students to create/prepare and deliver several presentations throughout the semester.

**Attribute(s):** NUpath Difference/Diversity, NUpath Creative Express/Innov

**PHTH 2301. Communication Skills for the Health Professions—Global. (4 Hours)**

Studies how to communicate effectively with patients, colleagues, and other professionals—regardless of race, culture, or ethnicity—on interpersonal, organizational, and global levels. Introduces traditional and new media health communication strategies, public speaking/presentation techniques, and communication as leaders in a global environment. Compares cultures and healthcare systems in the country of study with the American system by engaging with health professionals, patients, caregivers, and communications and other specialists. Introduces students to art and techniques of health communication for informing and influencing patients, caregivers, and the community-at-large. Offers students in the health professions an opportunity to learn interpersonal, organizational, mass media, and global communication skills to empower individuals to become health literate and participate in their own healthcare. May be repeated without limit.

**Attribute(s):** NUpath Difference/Diversity, NUpath Creative Express/Innov

**PHTH 2350. Community and Public Health. (4 Hours)**

Provides students with a basic familiarity with and appreciation of public health and community-based methods for improving the health of populations. Explores the purpose and structure of the U.S. public health system, contemporary public health issues such as prevention of communicable diseases, health education, social inequalities in health and healthcare, public health responses to terrorism, and control of unhealthy behaviors like smoking, drinking, drug abuse, and violence. Prior completion of PHTH 1260 is recommended but not required.

**Attribute(s):** NUpath Societies/Institutions

**PHTH 2351. Community and Public Health - Global. (4 Hours)**

Offers a basic familiarity with (and appreciation of) public health and community-based methods for improving the health of populations in a global context. Discusses the purposes and structures of the public health systems of the United States and the host country. Explores contemporary public health issues, including the global burden of disease; social determinants of inequalities in health and healthcare; communicable disease detection and management; environmental health risks; nutrition and physical activity; and unhealthy behaviors, such as substance use and violence. Analyzes the application of public health practices and principles to urban health concerns through the use of comparative case studies.

**Attribute(s):** NUpath Societies/Institutions

**PHTH 2414. Environmental Health. (4 Hours)**

Offers an overview of the field of environmental health, with focus on what the National Institute of Environmental Health Sciences terms "environmental public health." This broad field increasingly involves transdisciplinary approaches that use social science/environmental health collaborations, and it includes the physical, built, and social environments. Asks students to think critically about the economic, scientific, social, and political factors that shape environmental health and to consider how the field is relevant to other public health issues.

**PHTH 2515. Healthcare Policy and Administration. (4 Hours)**

Focuses on management and policy issues in healthcare. Discusses management and administrative structures in hospitals and other healthcare organizations, including community clinics and health organizations, both private and public. Introduces the financial systems, economic information, and payment mechanisms necessary to understand healthcare financing. Also explores the variety of factors that influence population health from a healthcare policy perspective. Offers students an opportunity to learn how to analyze, prepare, and write policy briefs based on understanding the various economic, legal, and political forces shaping healthcare in the United States.

**Prerequisite(s):** PHTH 1260 with a minimum grade of C or PHTH 1261 with a minimum grade of C

**PHTH 2616. Rural Health: An Interdisciplinary Seminar. (4 Hours)**

Addresses current issues in rural health. Maine, one of the nation's most rural states, is the primary case example. Highlights interdisciplinary approaches to identifying priority health concerns, addressing root causes of diseases and poor health and developing sustainable policy and programmatic interventions for improving health outcomes of individuals, families, and communities in rural areas. Reviews models of rural healthcare delivery, rural public health systems and practices, rural public policy and health reform, the role of health technologies in rural practice, and health disparities among vulnerable rural populations (including but not limited to immigrants, migrant workers, older people, people living with disabilities, LGBTQIA+ persons, and indigenous/first peoples). Critically analyzes the complex contextual factors that must be addressed to sustainably improve health outcomes in rural settings.

**Attribute(s):** NUpath Societies/Institutions

**PHTH 2991. Research in Public Health. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated once.

**PHTH 4120. Global Perspectives on Discrimination and Health. (4 Hours)**

Explores how discrimination can lead to population-level health disparities among marginalized groups globally. Topics include constructions of social categories, such as race and gender; differences in patterns of disease across populations, both intra- and internationally; how work from various disciplines, such as anthropology, medicine, and public health, inform understanding about how discrimination relates to health; and theoretical models from different disciplines that explain public health disparities.

**Prerequisite(s):** (PHTH 2350 with a minimum grade of C or PHTH 2351 with a minimum grade of C); (ENGW 3302 with a minimum grade of C or ENGW 3304 with a minimum grade of C or ENGW 3306 with a minimum grade of C or ENGW 3307 with a minimum grade of C or ENGW 3308 with a minimum grade of C or ENGW 3314 with a minimum grade of C or ENGW 3315 with a minimum grade of C)

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture, NUpath Writing Intensive

**PHTH 4202. Principles of Epidemiology in Medicine and Public Health. (4 Hours)**

Introduces the principles of epidemiology necessary to critically evaluate the published research in medicine, public health, and related fields. Through careful reading of literature, class discussion, and lectures, familiarizes students with the study of design-related considerations that are an indispensable part of interpreting scientific literature. Offers students an opportunity to learn how to recognize critical elements of research design and execution (e.g., loss to follow-up in randomized clinical trials and other cohort designs, selection bias in case control studies, etc.); identify the strengths and limitations of different approaches to research questions; deepen their understanding of causal inference; and recognize the provisional nature of scientific knowledge. Covers issues of statistical methods and data analysis; however, there are no computational requirements.

**Prerequisite(s):** (CRIM 3700 with a minimum grade of C or ECON 2350 with a minimum grade of C or ENVR 2500 with a minimum grade of C or INSH 3102 with a minimum grade of C or MATH 2280 with a minimum grade of C or MATH 3081 with a minimum grade of C or MGSC 2301 with a minimum grade of C or NRSG 5120 with a minimum grade of C or PHTH 2210 with a minimum grade of C or POLS 2400 with a minimum grade of C or PSYC 2320 with a minimum grade of C or SOCL 2320 with a minimum grade of C)

**Attribute(s):** NUpath Natural/Designed World

**PHTH 4511. Healthcare Management. (4 Hours)**

Provides an opportunity to develop skills and abilities related to management within the context of interdisciplinary study. Students explore issues in healthcare management in small-group, case-based educational experiences or problem-solving approaches. Within the context of small groups, students explore complex problems frequently encountered in clinical practice. Group projects related to leadership, management, or administrative issues are pursued and developed as classroom or poster presentations.

**Prerequisite(s):** PHTH 1260 with a minimum grade of C or PHTH 1261 with a minimum grade of C

**PHTH 4515. Critical Issues in Health and Public Health Policy. (4 Hours)**

Explores current public health and healthcare policy issues. Uses a case-based format to analyze, explain, and address ongoing problems within the U.S. public health and healthcare systems. Assesses the status of U.S. healthcare reform. Evaluates alternative payment mechanisms. Reviews national and state drug pricing negotiations, implications for drug development and patient access, and other current issues in public health and healthcare.

**Prerequisite(s):** PHTH 2515 with a minimum grade of C ; (ENGW 3302 (may be taken concurrently) with a minimum grade of C or ENGW 3304 (may be taken concurrently) with a minimum grade of C or ENGW 3306 (may be taken concurrently) with a minimum grade of C or ENGW 3307 (may be taken concurrently) with a minimum grade of C or ENGW 3308 (may be taken concurrently) with a minimum grade of C or ENGW 3314 (may be taken concurrently) with a minimum grade of C or ENGW 3315 (may be taken concurrently) with a minimum grade of C )

**Attribute(s):** NUpath Capstone Experience, NUpath Societies/Institutions

**PHTH 4540. Health Education and Program Planning. (4 Hours)**

Offers a writing-intensive course that introduces concepts central to health education and the program-planning process. Examines current public health issues that require intervention through health education or other types of prevention programs. Studies and applies models and theories used in health education and program planning. Offers students an opportunity to conduct a needs assessment; design and plan a program for a public health issue; create a mission statement for the program as well as goals, objectives, and strategies; and design the intervention, develop an evaluation plan, and create a budget and marketing plan. Prior completion of PHTH 2300 and PHTH 2350 is recommended but not required.

**Prerequisite(s):** ENGW 3306 with a minimum grade of C or ENGW 3302 with a minimum grade of C or ENGW 3304 with a minimum grade of C or ENGW 3307 with a minimum grade of C or ENGW 3308 with a minimum grade of C or ENGW 3314 with a minimum grade of C or ENGW 3315 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**PHTH 4602. Private Guns, Public Health. (4 Hours)**

Introduces a public health approach to preventing firearm violence in the United States. Reviews the epidemiologic basis for prevention approaches, including why reducing access to firearms can prevent suicide deaths; structural obstacles to gun violence research; and how researchers have tried to overcome these impediments. Covers perspectives on firearm violence prevention from medicine, criminology, law, and economics. Offers students an opportunity to synthesize concepts from prior coursework, especially from epidemiology, and bring this background to close reading and class discussion of journal articles. Focuses on how different study designs are well or ill suited to address pressing questions related to gun violence.

**Prerequisite(s):** CRIM 3600 with a minimum grade of C or INSH 3101 with a minimum grade of C or PHTH 4202 with a minimum grade of C or SOCL 2321 with a minimum grade of C

**Attribute(s):** NUpath Capstone Experience

**PHTH 4616. Addressing Rural Health Inequities. (4 Hours)**

Presents an overview of health inequities among rural populations and seeks to facilitate understanding of the complex causes through a public health perspective. Investigates innovative approaches to addressing rural health challenges, and provides examples of evidence-based policy, program, and technological interventions that impact the health and well-being of rural communities. Explores public health and healthcare issues that have been at the core of the health sciences/public health curriculum. Offers students an opportunity to select a specific rural health inequity in a defined geographic area as the focus of a final capstone project.

**Attribute(s):** NUpath Capstone Experience

**PHTH 4717. Advancing Health Justice Through the Law. (4 Hours)**

Uses pressing challenges at the intersection of public health and safety to build skills and expertise in public health law and public health law research. Utilizes the active portfolio of the Action Lab of the Northeastern University School of Law's Center for Health Policy and Law to build student capacity in project management, mixed methods research, and policy/program evaluation. Offers students an opportunity to gain direct experience devising solutions to real-world problems through project-based learning in the form of a term project, matching student interests with the Action Lab's ongoing initiatives.

**Attribute(s):** NUpath Capstone Experience

**PHTH 4818. Let's Talk About Sex: Exploring Key Topics and Current Issues in Sexual and Reproductive Health. (4 Hours)**

Provides a comprehensive examination of sexual and reproductive health (SRH) issues. Explores foundational concepts in human sexuality, including sexually transmitted infections (STIs), reproductive anatomy, sexual response, and the portrayal of sex in media. Explores contemporary SRH issues, such as reproductive rights in the post-Roe v. Wade era, sexual health education policies, and access to contraception. Evaluates the factors shaping SRH issues and explore potential strategies for addressing them.

**Attribute(s):** NUpath Capstone Experience

**PHTH 5120. Race, Ethnicity, and Health in the United States. (3 Hours)**

Explores the role of economic, social, and individual factors in explaining racial and ethnic health disparities and examines intervention approaches to eliminate them. Topics include genetic and social constructions of race and ethnicity, measuring race and ethnicity, and the differences in prevalence and patterns of disease across groups; cultural and structural factors that affect healthcare delivery, such as discrimination, racism, and health status; and public health approaches to prevention and improving healthcare delivery.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture, NUpath Writing Intensive

**PHTH 5202. Introduction to Epidemiology. (3 Hours)**

Introduces the principles, concepts, and methods of population-based epidemiologic research. Offers students an opportunity to understand and critically review epidemiologic studies. Lectures and discussions aim to serve as a foundation for training in epidemiology, quantitative methods, and population-based health research. The course is a required introductory course for students in the Master of Public Health program and is appropriate for students who are interested in epidemiologic research. Students not meeting course restrictions may seek permission of instructor.

**PHTH 5210. Biostatistics in Public Health. (3 Hours)**

Offers public health students an opportunity to obtain the fundamental concepts and methods of biostatistics as applied predominantly to public health problems and the skills to perform basic statistical calculations. Emphasizes interpretation and comprehension of concepts. Topics include descriptive statistics, vital statistics, sampling, estimation and significance testing, sample size and power, correlation and regression, spatial and temporal trends, small area analysis, and statistical issues in policy development. Draws examples of statistical methods from the public health practice. Introduces use of computer statistical packages. Requires permission of instructor for students outside designated programs.

**PHTH 5212. Public Health Administration and Policy. (3 Hours)**

Offers students an opportunity to obtain practical knowledge concerning the planning, organization, administration, management, evaluation, and policy analysis of health programs. Surveys what we know and think about public health administration and policy and what we do in practice. Introduces the main components of public health policy and administration using notable conceptual frameworks and case studies. Requires permission of instructor for students outside designated programs.

**PHTH 5214. Environmental Health. (3 Hours)**

Introduces the field of environmental health, which encompasses concerns related to physical, built, and social environments. Discusses the tools used to study environmental exposures and diseases. Examines environmental health hazards, the routes by which humans are exposed to hazards, various media in which they are found, and disease outcomes associated with exposures. Offers students an opportunity to become familiar with methods used to conduct environmental health research and with the federal and state agencies responsible for protecting environmental health.

**Attribute(s):** NUpath Capstone Experience

**PHTH 5222. Health Advocacy. (3 Hours)**

Seeks to educate students about the role of advocacy in public health while providing tools and support to address current healthcare issues. Provides information and theory about advocacy, education, and community organizing in public health practice and skills geared toward direct application. Covers various techniques related to developing and conducting an advocacy project within a community setting. Offers students an opportunity to develop, communicate, and refine a community-based advocacy program. Requires permission of instructor for students outside designated programs.

**PHTH 5226. Management and Leadership in Public Health and Healthcare. (3 Hours)**

Focuses on leadership and management challenges facing public health and healthcare organizations, particularly community-based agencies and their role in public health and healthcare delivery systems. Introduces strategic thinking, negotiation, and leadership approaches that must be considered for managing a successful public health or healthcare organization. Selected topics include strategic planning; organizational development and barriers to organizational change; management strategies and principles; approaches to negotiation in public health and healthcare settings; systems thinking; and the key elements for effective organizational leadership.

**PHTH 5230. Global Health. (3 Hours)**

Presents an overview of global health issues and focuses on less economically developed countries. Covers measures of disease burden; demography of disease and mortality; Millennium Development Goals (under the auspices of the United Nations); infectious diseases such as HIV/AIDS, tuberculosis, and malaria and their prevention; vaccine utilization and potential implications; chronic diseases; tobacco-associated disease; nutritional challenges; behavioral modification; mother and child health; health human resources; and ethical issues in global health.

**Attribute(s):** NUpath Capstone Experience

**PHTH 5232. Evaluating Healthcare Quality. (3 Hours)**

Focuses on the conceptual and methodological foundations for evaluating the quality of care of healthcare providers—both individual providers and healthcare organizations. Aimed at students pursuing careers in public health, public policy, healthcare management, and the various health professions in the growing field of quality evaluation and improvement. Also designed to give healthcare providers an appreciation for how they may be evaluated. Examines scientific issues in the measurement of quality of care as well as key quality evaluation methods. Also covers the use of risk adjustment and other methodologies for comparing the quality of healthcare providers. Focuses on mechanisms that assess quality, including licensure, accreditation, and board certification.

**PHTH 5234. Economic Perspectives on Health Policy. (3 Hours)**

Uses basic economic concepts to illuminate the many factors that shape health, healthcare, and the healthcare system in the United States. Examines the role of these concepts in explaining the challenges faced in achieving three core goals of the healthcare system: increasing access, limiting cost, and improving quality. Explores how policy makers, market participants, and others can remedy access, cost, and quality deficiencies. Illustrates how economic concepts can be applied to the study of health and health behaviors.

**PHTH 5236. Food, Nutrition, and Health. (3 Hours)**

Uses an interdisciplinary lens to examine issues at the intersection of food, nutrition, and health. Explores how food is distributed and analyzes the relationships between food retailers and food banks and how this affects food access. Investigates the role of public health services, policies and legislation, funding, marketing, and communication strategies for the development, evaluation, implementation, and dissemination of nutrition programs. Examines and critiques the role of food in the US healthcare industry, including “Food Is Medicine” interventions, clinic-based food referrals, and how these interventions address chronic diseases like diabetes, obesity, and hypertension.

**Attribute(s):** NUpath Capstone Experience

**PHTH 5300. Project Management in Public Health. (1 Hour)**

Presents principles of project management as applied to public health organizations and their programs. Offers students an opportunity to learn the components of the project management life cycle, including human resource components, material resources, and related components.

**PHTH 5310. Budget Principles in Public Health. (1 Hour)**

Details the public health revenue and funding environment, identifies key budget development functions, and describes the importance of utilizing the budget process for sound management of the programs. Public health programs in public agencies and nonprofit organizations require managerial skills to assure that programs are implemented efficiently and effectively. Funding for public health frequently comes from governmental revenue sources—federal and state budgets or grants from government or foundations. It is critical that the funds are utilized well and appropriate to the objectives of the agency and program. Advancing the environment for public health through effective budgeting and promotion of program impact is important to support the continued funding for public health. The course takes students through these topics and offers them the opportunity to gain the practical experience of developing a budget for a public health program as the central activity.

**PHTH 5320. Grant Writing in Public Health. (1 Hour)**

Explores the grant funding landscape, identifies different types of funders and grants, and identifies potential funders. Offers participants an opportunity to develop their skills in grant writing and in reviewing grants, to develop a grant proposal, and to understand the submission and peer review process.

**PHTH 5350. Using SAS in Public Health Research. (1 Hour)**

Introduces the SAS statistical software system to manage, report, summarize, and analyze public health data. The SAS suite can be used to provide a broad analysis of different types of data. Public health research often requires one to access, manipulate, and analyze datasets relating to individuals, groups, or healthcare systems. Explores approaches in SAS to accessing datasets, data manipulation, working with multiple datasets, summarizing and reporting data, and analytic results. Includes various statistical methods and testing procedures, such as t-tests, chi-square tests, and linear regression, to illustrate applications of SAS. The second part of the course explores more advanced programming methods, including SAS macros, using the Output Delivery System and data arrays.

**PHTH 5360. AI at the Intersection of Health and Society. (3 Hours)**

Studies how artificial intelligence can be applied in the domain of health and the issues that arise as a result. Examines how AI tools could affect social determinants of health, which are conditions that influence health and well-being (e.g., poverty, education, work, place, as well as discrimination by gender and racial identities). Explores the principles of machine learning predictions, classification, causality, and fairness. Covers the techniques to mitigate such concerns, notably through human-centered AI, participatory design, and value-sensitive design.

**PHTH 5540. Health Education and Program Planning. (3 Hours)**

Focuses on underlying concepts of health education and explores current health education issues that require intervention. Covers program planning models and theories used in health education. Offers students an opportunity to develop a working knowledge of the planning process for health education through the analysis of case studies and by creating a program plan to address a health issue of their choice.

**Prerequisite(s):** (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C) or graduate program admission

**Attribute(s):** NUpath Writing Intensive

**PHTH 5560. Public and Community Health Program Evaluation. (3 Hours)**

Focuses on health equity, constrained funding, and an increasing need for evidence that public health programs work to improve health and social outcomes. Covers evaluation methods to help students acquire the technical skills necessary to design a comprehensive, rigorous, viable evaluation plan for a local community-based organization. Utilizes active learning strategies and partnership with a local community health partner organization to support relevance of course content. Explains the technical tasks of defining stakeholders. Articulates theories of change using logic models. Identifies appropriate process and outcome evaluation indicators using quantitative and qualitative methods.

**Prerequisite(s):** PHTH 4540 with a minimum grade of C or (PHTH 5540 with a minimum grade of C or PHTH 5540 with a minimum grade of B (Graduate))

**Attribute(s):** NUpath Capstone Experience

**PHTH 5603. Qualitative Methods. (4 Hours)**

Introduces the principles and use of common qualitative methods with a particular focus on their application in the social sciences. Students practice designing qualitative research. Offers students an opportunity to gain experience using diverse analytic and theory building techniques, conducting field observations and interviews, and analyzing content. Examines the foundation of core concepts in research. Topics include objectivity, bias, empiricism, validity, triangulation, and ethical issues surrounding human subjects—such as confidentiality, anonymity, and vulnerable populations.

**PHTH 6130. Public Health Technologies: Ethics and Equity. (3 Hours)**

Offers students an opportunity to develop an understanding of the multiple forms of technology that are deployed to advance both healthcare and public health and the broad range of ethical challenges and individual and community-level disparities associated with these technologies. Examines theoretical and conceptual frameworks to address disparities associated with public health technologies. Explores case studies to understand how a social justice framework can be applied to the development, implementation, and evaluation of public health technologies.

**PHTH 6200. Principles and History of Urban Health. (3 Hours)**

Focuses on the aspects of urban development and life that impact the health and well-being of city residents. Offers students an opportunity to learn about the impact of migration patterns, built environments, occupational stratification, and other cultural and community contextual factors that impact health status and healthcare access. Examines the level of overall health and healthcare found in urban populations, particularly the urban poor, and the disproportionate impact on racial and ethnic minorities in the United States and elsewhere. Considers public policy approaches for addressing the unique health issues of urban areas. Examines urban health issues both from a national and international perspective. Requires permission of instructor for students outside designated programs.

**Attribute(s):** NUpath Capstone Experience

**PHTH 6202. Intermediate Epidemiology. (3 Hours)**

Offers an intermediate-level course covering key principles, concepts, and methods of population-based epidemiologic research. Topics include observational study designs, measures of disease occurrence and association, validity and bias, confounding, effect modification, multivariate analysis for stratification and adjustment, critical appraisal and meta-analysis, mediation analysis, missing data analysis, and concepts and methods for strengthening causal inference. Offers graduate students unique opportunities to engage in practical applications, including critical reviews of published epidemiologic journal articles, and to conduct hands-on analyses of empirical datasets using SAS statistical software. Designed to serve as a foundation for further advanced training in specialized branches of epidemiology, quantitative methods, and epidemiologic research.

**Prerequisite(s):** PHTH 5202 with a minimum grade of B-

**PHTH 6204. Society, Behavior, and Health. (3 Hours)**

Explores individual, interpersonal, and social influences on health. Offers students in public health an opportunity to learn the application of the social and behavioral sciences. Examines foundations of public health, including prevention and the prevention paradox, theories of disease causation, and public health ethics. In addition, multilevel influences on health are examined, including behavioral theories and social determinants of health. Throughout the semester, attention is paid to disparities in health. Finally, we examine strategies to reduce health disparities, such as education, interventions, and policy-level changes, and discuss their relative effectiveness. Requires permission of instructor for students outside designated programs.

**PHTH 6208. Foundations of Community Health Assessment. (3 Hours)**

Offers an opportunity to develop a basic understanding of the complex public health issues confronting communities across the nation. Uses a community organization and development framework for public health practice. Seeks to provide skills, tools, and experiential learning opportunities that result in community assessments that may be used in public health planning, programming, and policy. Covers key principles and methods for conducting community health assessments utilizing a range of quantitative and qualitative methods, including community epidemiology, major data sets, surveillance data, behavioral risk and other population-based surveys, as well as other primary and secondary data sources. Includes collaborative and interactive exercises, including self- and group reflection, Internet and contemporary media exploration, and in-class discussions.

**PHTH 6210. Applied Regression Analysis. (3 Hours)**

Builds upon the fundamental concepts and methods of biostatistics with applications to health disciplines. Topics include hypothesis testing, analysis of variance, linear regression, multiple regression, and logistic regression. Examples and readings are drawn from the public health literature. The SAS statistical software package is introduced and used throughout the course.

**Prerequisite(s):** PHTH 5210 with a minimum grade of B-

**PHTH 6224. Social Epidemiology. (3 Hours)**

Focuses on social epidemiology, which is defined as the study of the distribution and determinants of health in populations as related to the social and economic determinants of health. Includes theories, patterns, and controversies, as well as programs and policies that can be applied to address health inequalities. Readings include articles that situate one dimension of social epidemiology with articles addressing the empirical patterns, address prevailing theories and controversies regarding the causes of the inequalities, as well as address interventions or policies that may be applied to address the inequalities.

**Prerequisite(s):** (PHTH 5202 with a minimum grade of B- or PHTH 5202 with a minimum grade of B- ); (PHTH 5210 with a minimum grade of B- or PHTH 5210 with a minimum grade of B- )

**PHTH 6320. Qualitative Methods in Health and Illness. (3 Hours)**

Discusses qualitative inquiry in general and specifically in topics related to public health and experiences of self, health, illness, and the body. Qualitative research aims to achieve in-depth and contextual understanding of people, culture, and societies and usually employs texts, interviews, published materials, images, and focus group discussions as sources of data. The course integrates theoretical and methodological readings and discussions with designing and conducting a qualitative project. Offers students an opportunity to understand meanings of health, illness, and the body in a variety of "local worlds" and reflect on their importance for informing policy, public health, research, and practice. Requires prior completion of one undergraduate- or graduate-level course in research methods.

**PHTH 6400. Principles of Population Health 1. (3 Hours)**

Seeks to provide students with historical background and methodological and critical-thinking tools needed to perform high-quality, interdisciplinary research in population health. Using a problem-solving and interdisciplinary framework, offers students an opportunity to gain the skills to develop research hypotheses, design research strategies, analyze data to test study hypotheses, and communicate their findings both orally and in writing. Also offers students an opportunity to gain experience in research methodology and application of basic methods for population health research, including epidemiological and biostatistical concepts. Finally, students demonstrate their mastery of these skills through problem sets and through written proposals that include communication of preliminary data.

**Prerequisite(s):** PHTH 5210 with a minimum grade of C- or PHTH 5210 with a minimum grade of D-

**PHTH 6410. Principles of Population Health 2. (3 Hours)**

Continues PHTH 6400, exploring additional population health research topics and methods and applying more advanced biostatistical and epidemiological analysis methods.

**Prerequisite(s):** PHTH 6400 with a minimum grade of C-

**PHTH 6440. Advanced Methods in Biostatistics. (3 Hours)**

Explores in detail the analysis of complex survey design, including adjustments for cluster sampling, weighting, and stratification. Designs that incorporate clustering of data are common in health science research. These designs are characterized by data that capture nonindependent repeated measurements on primary sampling units or that collect data with schemes more complex than simple random sampling. The statistical analyses of these types of data need to include appropriate adjustments to provide proper estimates and accurate testing. The second part of the course investigates the use of mixed regression models to analyze repeated measurements on individuals, multilevel data, and growth models.

**Prerequisite(s):** PHTH 6210 with a minimum grade of C-

**PHTH 6800. Causal Inference in Public Health Research. (3 Hours)**

Exposes students to causal inference approaches, including causal diagrams and counterfactual theory. Students are also asked to draw upon their own research experiences and prior epidemiology training to evaluate public health studies. Covers how to apply the fundamental concepts of counterfactuals and causal diagrams; assess threats to validity in study designs and analysis, including confounding, selection bias, and measurement error/misclassification; evaluate the validity of a public health research study's design and analysis with respect to addressing causal questions; and critically analyze scientific literature and apply findings to clinical or policy decisions. Offers students an opportunity to think critically and rigorously about the implications of study design and analysis toward addressing public health questions.

**Prerequisite(s):** PHTH 6202 with a minimum grade of C-

**PHTH 6801. Causal Inference 1. (4 Hours)**

Introduces causal inference approaches, including causal diagrams and counterfactual theory. Draws upon personal research experiences and/or prior training. Covers insights on how to apply the fundamental concepts of counterfactuals and causal diagrams; assess threats to validity in study designs and analysis including confounding, selection bias, and measurement error/misclassification; evaluate the validity of a research study's design and analysis with respect to addressing causal questions; and critically analyze scientific literature and apply findings to decisions. Offers students an opportunity to think critically and rigorously about the implications of study design and analysis toward addressing questions.

**PHTH 6802. Causal Inference 2. (4 Hours)**

Continues PHTH 6801. Expands on foundational knowledge of causal inference by examining time-varying exposures, introducing the g-formula for estimating standardized outcome distributions, and unraveling the intricacies of marginal structural models. Navigates through key topics, including static and dynamic treatment regimes. Engages in discussions on sensitivity analysis, graphical models, identification algorithms, and the complex domain of causal discovery. Examines advanced techniques in causal inference, offering students an opportunity to apply theoretical principles to practical scenarios. Tackles challenging aspects such as time-varying exposures and sophisticated modeling techniques in the pursuit of accurate and meaningful outcomes.

**Prerequisite(s):** PHTH 6800 with a minimum grade of B or PHTH 6801 with a minimum grade of B

**PHTH 6810. Survival Analysis. (4 Hours)**

Focuses on the theoretical understanding and computational analysis of time-to-event data, which may or may not be censored or truncated through the course of their collection. Presents foundational nonparametric methods, such as the log-rank test and Kaplan-Meier curves and a deeper discussion of the Cox proportional hazards model. Discusses power and sample size techniques for methods. Reviews examples from public health, clinical trials, and large-scale observational health studies.

**PHTH 6820. Design and Analysis of Clinical Trials. (4 Hours)**

Presents theoretical and computational aspects of conducting clinical trials research. Covers topics such as phase 1, 2, 3, and 4 trials. Explores creation of a statistical analysis plan, adaptive study designs, randomization techniques, interim monitoring, and reporting. Offers students an opportunity to practice a programming language for regulatory decision making, a solid foundation in the theoretical and computational aspects of conducting clinical trials research, and exercising the skills needed for success in this critical field. Applies theoretical concepts through practical exercises.

**PHTH 6830. Generalized Linear Models. (4 Hours)**

Focuses on selecting, fitting, and evaluating the general class of generalized linear models. Emphasizes linear, logistic, Poisson, and proportional hazards regression in addition to time series analyses. Stresses proper construction of models through the evaluation of modeling assumptions and assessment of model diagnostics. Introduces concepts of confounding, effect modification, and methods for missing data. Offers students an opportunity to fit, evaluate, and appropriately communicate and visualize the results of modeling techniques using a programming language and statistical software packages, as well as practice on techniques for data cleaning on real examples of messy data.

**PHTH 6880. Statistical Consultancy. (1 Hour)**

Offers students an opportunity to demonstrate skills including problem solving, communication, visualization, and adaptability through a consultancy small group project. Students work in interdisciplinary groups in a consultancy role. Topics include problem solving, consulting session management, written and oral communication, research ethics, experiment design, data collection, and application of statistical and data visualization methods with real-world problems. May be repeated once.

**Prerequisite(s):** MATH 5010 with a minimum grade of B ; PHTH 6830 with a minimum grade of B

**PHTH 6910. Public Health Capstone. (3 Hours)**

Offers students an opportunity for scholarly work on-site in a range of diverse public health settings reflective of their particular urban health focus. Students have an opportunity to integrate their theory and practice experiences in a major research, program planning, program implementation, policy development, management, service delivery, or evaluation project. Student-led and designed in consultation with community partners and faculty advisors, seeks to support students in the implementation and completion of their projects.

**Prerequisite(s):** PHTH 6966 with a minimum grade of B-

**PHTH 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PHTH 6966. Practicum. (3 Hours)**

Provides eligible students with an opportunity for practical experience.

**PHTH 7101. Qualitative Research Design. (4 Hours)**

Introduces the logic of qualitative inquiry and various qualitative data collection strategies including field observation, in-depth interviews, focus groups, and archival materials. Suitable for students in a range of social scientific disciplines including anthropology, sociology, political science, public policy, criminal justice, population health, nursing, and applied psychology. Offers students an opportunity to obtain a foundation for essential aspects of research design as well as hands-on experience in data collection techniques around a topic of the student's choosing.

**PHTH 7102. Qualitative Data Analysis. (4 Hours)**

The goal of this course is to introduce students to methods for analyzing different forms of qualitative data. The course will train students in developing coding strategies to analyze qualitative data and introduces them to qualitative data software. Students will learn how to apply deductive and inductive coding, how to develop coding structures appropriate for various genres (e.g., exploratory, descriptive, narrative), and how to theorize from qualitative data. Students will receive extensive training in writing up qualitative research findings, from analytic memos to a publishable paper or dissertation chapter.

**Prerequisite(s):** INSH 5603 with a minimum grade of C or INSH 5603 with a minimum grade of C or INSH 7101 with a minimum grade of C or PHTH 5603 with a minimum grade of C or PHTH 5603 with a minimum grade of C or PHTH 7101 with a minimum grade of C

**PHTH 7103. Mixed Methods Research. (4 Hours)**

Introduces the theory and practice of mixed method inquiry in the social sciences, broadly defined. Presents an overview of historical roots of mixed methods research, the major paradigms driving contemporary mixed methods research, and the four most common research designs applied in mixed methods research (concurrent, sequential, embedded, and multiphase). Studies how to evaluate the validity and quality of mixed methods research. Offers students an opportunity to develop a research protocol for a mixed methods research project.

**PHTH 7976. Directed Study. (1-3 Hours)**

Offers the student the opportunity to bring individual, concentrated attention to a particular public health topic or competency area as arranged and agreed upon in advance by a faculty member and the student. This option is generally recommended when the student desires a more intensive analysis of a particular subject. May be repeated without limit.

**PHTH 8960. Exam Preparation—Doctoral. (0 Hours)**

Offers students an opportunity to prepare for the PhD qualifying exam under faculty supervision.

**PHTH 8984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**PHTH 8986. Research. (0 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**PHTH 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of program requirements for PhD candidacy.

**PHTH 9990. Dissertation Term 1. (0 Hours)**

Offers doctoral students an opportunity to work with their advisors and doctoral research committees to perform their doctoral research and to write their dissertation.

**Prerequisite(s):** PHTH 9000 with a minimum grade of S

**PHTH 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** PHTH 9990 with a minimum grade of S

**PHTH 9996. Dissertation Continuation. (0 Hours)**

Offers continuation of dissertation research to doctoral students.

**Prerequisite(s):** PHTH 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Public Policy and Urban Affairs (PPUA)

### PPUA 4992. Directed Study. (1-4 Hours)

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

### PPUA 5100. Climate and Development. (4 Hours)

Serves as an introduction to climate change and development processes in developing countries. Exposes students to key debates in the fields of climate change and international development. Offers students an opportunity to learn about the approaches to climate adaptation, the relationship between adaptation and development, and concepts of resilience and transformation. Using a comparative case study approach, explores the importance of the local context; the intersections of politics, economics, and culture; ecology and human-environment relationships; and the role (and challenges) of finance and development assistance. Climate impacts threaten to reverse many of the development gains of the last century, and the most vulnerable are likely to be the most impacted by climate change. At the same time, opportunities exist to ensure climate-compatible development pathways. Cross-listed with INTL 5100.

**Attribute(s):** NUpath Societies/Institutions

### PPUA 5201. Urban Planning and the Law. (2 Hours)

Addresses the role of law in defining the powers of planning and the legal questions surrounding key urban planning debates. Studies specifically the powers that city governments have to adopt to implement policies; debates about whether such powers should be expanded or restricted; the legal basis of government's ability to intervene in housing, real estate development, land use and acquisition, and other planning issues, as well as debates about such powers; and the roles of federal and state governments in determining what cities can do. Examines these issues by analyzing legal structures, court decisions, and social research.

### PPUA 5220. How Healthcare Works: Business and Policy Innovations. (4 Hours)

Offers a high-level introduction to the past, current, and future states of the U.S. healthcare system, including key business and policy innovations introduced over time to improve access, quality, and affordability. Emphasizes learning about how the business and policy of healthcare works in the United States, with comparisons drawn to other countries' healthcare systems. Analyzes the potential contributions to health system improvement made by healthcare reform, technologies such as artificial intelligence, and other disruptive innovations. Designed for students interested in learning more about healthcare industry operations and the business and policy innovations that drive performance improvements in this sector.

### PPUA 5225. The Open Classroom: Public Debates on Public Policy. (4 Hours)

Offers special topics built around a series of public debates on selected issues of public policy. May be repeated without limit.

### PPUA 5226. Open Classroom Recitation. (0 Hours)

Accompanies PPUA 5225. Provides a small-group discussion format. May be repeated without limit.

**Corequisite(s):** PPUA 5225

### PPUA 5230. Housing Policy. (4 Hours)

Examines the economic, social, and legal underpinnings of housing policy in the United States across a variety of topics, including housing finance and production, public and affordable housing, home ownership, and fair housing. Housing is both an essential human need and a critical sector of the U.S. economy. Presents the complicated and evolving roles of all of those involved in housing policy, including federal, state, and local government, and the private and profit sectors. Guest speakers provide real-world insights into current housing policy challenges.

### PPUA 5231. Transportation Policy. (4 Hours)

Examines the physical, technological, economic, social, cultural, and political underpinnings of transportation policy in the United States. Topics include intra- and interstate transportation, the comparative economics of different modes of transportation, the impacts of federal and state policies on transportation options, and the long-term effects of those choices on metropolitan development, housing, land use, energy, and the environment. Also involves comparisons with transportation systems in other countries.

**PPUA 5232. Immigration and Urban America. (4 Hours)**

Examines the policy impacts of legal and illegal immigration in the United States, emphasizing the ways immigration shapes urban America. Discusses trends in immigration; elements of U.S. immigration policy; impacts of immigration on labor markets, economic development, housing, education, healthcare, criminal justice, race relations, and social policy (e.g., welfare); and effects on broader mass culture. Also considers the range of policy tools available in addressing these impacts.

**PPUA 5233. Contemporary Community Development. (4 Hours)**

Explores the political and social dynamics of community development in urban America, with particular focus on the local politics of housing, economic development, jobs, healthcare, access to services, and community safety. Uses Boston and its region as a laboratory to examine the role of grassroots community groups in shaping their neighborhoods, set within the broader institutional contexts that affect their representation and impacts.

**PPUA 5234. Land Use and Urban Growth Policy. (4 Hours)**

Explores the evolution of land use and urban form in the United States and surveys different types of land-use and urban-growth management tools used by local, regional, and state governments. Examines the environmental, economic, spatial, and social impacts of different patterns of urban growth, including "sprawl" and "smart growth," and the different philosophies and legal and policy approaches employed to manage those impacts. Also explores how land-use and urban-growth policy interacts with related priorities, including housing, infrastructure, and fiscal policy. Focuses on current and emerging issues and debates in land-use and urban-growth management, such as New Urbanism, livable communities, and transit-oriented development.

**PPUA 5235. Participatory Community Planning Methods. (4 Hours)**

Examines the role of the participant as a fundamental aspect of most urban planning processes. Studies the range of strategies that contemporary urban planners employ to ensure buy-in from a project's stakeholders. Utilizes historical precedents to locate gaps between the "plan then present" model used in many planning processes and "co-design" processes that seek to redefine the role of the "technical expert." Offers students an opportunity to develop a toolkit of engagement methods from varied models of participatory planning processes. Engages in project-based work that enlists these methods. Assesses the efficacy of these methods when identifying the right stakeholders and when determining when/how to bring stakeholder participation into a planning process.

**PPUA 5236. Introduction to Real Estate Development for Urban Policy Makers. (4 Hours)**

Introduces the basic skills and knowledge of real estate development used within public-private partnerships to address policy and planning issues. Through a series of problem sets, offers students an opportunity to learn basic real estate finance and computation, including the fundamentals of pro forma modeling. Covers the entire real estate development process, from preliminary market and financial analysis through to construction management and property management using case studies and guest lecturers. Explores how public-private partnerships shape the outcomes of urban redevelopment within specific topics that may include affordable housing provision, brownfield redevelopment, transit-oriented development, sustainable urban development, and others.

**PPUA 5238. Climate Change and Global Urbanization. (4 Hours)**

Focuses on the climate-change-related challenges that confront rapidly urbanizing countries, particularly the low- and middle-income countries of Asia, Africa, and Latin America. Many of the largest and most rapidly growing cities in these regions are in low-lying coastal cities in river deltas and, consequently, face significant dangers of flooding and eventual inundation. Climate change also has implications for access to freshwater and for the incidence of heat waves. The impacts of climate-change-related hazards tend to fall most heavily on the poorest, raising new issues of social inequality. This course examines concepts of urban vulnerability and resilience and climate change adaptation, as well as case studies of policy approaches for addressing the impacts of climate change on cities.

**PPUA 5240. Health Policy and Politics. (4 Hours)**

Examines contemporary healthcare policies, programs, and politics. Discusses the structure of the healthcare system and its costs, efforts to develop universal health coverage, the spread of managed care, and related topics.

**PPUA 5244. Comparative Public Policy and Administration. (4 Hours)**

Examines public policy and administration across nations through the lens of politics, policy, and bureaucracy, and with respect to the role of government in society. Focuses on global perspectives of governance, government, and state making. Examines specific countries and policies to point out structural and operational similarities and differences. Emphasizes the implementation of public management reform in various countries, the use and application of the comparative method, factors that determine global policy outcomes, and the bureaucratic organization of the world and its role in organizing the state.

**PPUA 5245. Education Policy in the United States. (4 Hours)**

Examines the major policies and political dynamics that shape the delivery of educational services in the United States. Reviews the historical role of public education in American society and examines the legal context and intergovernmental relationships that provide the political framework for public education. Explores school finance, accountability and assessment strategies, issues of race and poverty, as well as major reform initiatives. Focuses on elementary and secondary education.

**PPUA 5246. Participatory Modeling for Collaborative Decision Making. (4 Hours)**

Studies participatory modeling, a knowledge coproduction and collaborative approach to decision making. The collaborative approach strengthens relationship building, empathy, trust, systems thinking, and collective agency for decision making. Participatory modeling allows researchers and decision makers to coproduce knowledge and shared representations of a complex problem and design and test solutions to address it. Using various modeling techniques (e.g., spatial analysis, causal loop diagraming, fuzzy cognitive mapping), participatory modeling helps elicit diverse stakeholder knowledge and harnesses this diversity to move from conflict to solutions.

**PPUA 5249. Sustainable Urban Coastal Policy. (4 Hours)**

Focuses on the challenges facing coastal cities and the ecosystems on which they depend by exploring both threats such as climate change as well as adaptation measures that promote resilience. Aimed at students interested in the interface of science and public policy and those who wish to gain a deeper understanding of how coupled human-natural ecosystems operate.

**PPUA 5250. Conservation Science and Policy. (4 Hours)**

Introduces students to the unprecedented human-driven changes to the environment that have motivated global conservation efforts and the integrated socio-ecological approach that is critical to their success. Examines the intersecting social, ecological, and political dimensions of conservation. Offers students an opportunity to develop skills in interdisciplinary and cross-scale synthesis for creative problem solving.

**PPUA 5260. Ecological Economics. (4 Hours)**

Introduces methods and tools of ecological economics, an interdisciplinary field that draws on theories, concepts, and tools from the physical, life, and social sciences; unites the relevant aspects of different disciplines; and generates new knowledge that can serve as a basis for investment and policymaking that is responsive to biophysical constraints on economic processes. Illustrates the use of ecological economics with empirical applications. Offers students an opportunity to apply ecological economics to a variety of environmental issues.

**PPUA 5261. Dynamic Modeling for Environmental Decision Making. (4 Hours)**

Introduces the theory, methods, and tools of dynamic modeling for policy and investment decision making, with special focus on environmental issues. Makes use of state-of-the-art computing methods to translate theory and concepts into executable models and provides extensive hands-on modeling experience. Topics include discounting, intertemporal optimization, dynamic games, and treatment of uncertainty.

**PPUA 5262. Big Data for Cities. (4 Hours)**

Investigates the city and its spatial, social, and economic dynamics through the lens of data and visual analytics. Utilizes large public datasets to develop knowledge about visual methods for analyzing data and communicating results. Offers students an opportunity to develop a critical understanding of data structures, collection methodologies, and their inherent biases.

**PPUA 5263. Geographic Information Systems for Urban and Regional Policy. (4 Hours)**

Studies basic skills in spatial analytic methods. Introduces students to some of the urban social scientific and policy questions that have been answered with these methods. Covers introductory concepts and tools in geographic information systems (GIS). Offers students an opportunity to obtain the skills to develop and write an original policy-oriented spatial research project with an urban social science focus.

**PPUA 5264. Energy Democracy and Climate Justice: Technology, Policy, and Social Change. (4 Hours)**

Examines two interconnected concepts: energy democracy—a social movement that frames the transformation to a renewable-based society as an opportunity to advance social, racial, and economic justice—and climate justice—an intersectional, equity-focused framework to prioritize societal responses to the worsening climate crisis. Explores the economic injustices and racial disparities that are expanding climate vulnerabilities. Considers analytical frameworks such as antiracist, feminist principles. Examines fossil fuel phaseout and other changes to energy and climate systems as solutions to reducing fossil fuel reliance. Explores tensions associated with systemic vs. incremental change, individual vs. collective action, centralized vs. decentralized power, and concentrated vs. distributed wealth. Semester-long team projects provide opportunities to collaborate with organizations advancing energy democracy and climate justice.

**Attribute(s):** NUpath Integration Experience

**PPUA 5265. Global Urbanization and Planning. (4 Hours)**

Explores the issues facing rapidly growing cities in the developing world. By 2040, more than half of the world's population will live in cities. Analyzes the forces driving a country's economic development and social change. Focuses on urbanization in poorer countries by examining what causes rapid urbanization; why informal economies are so pervasive and how governments approach this issue; the implications increasing popular demands for involvement in decisions have for urban planning and policy; and how governments respond to globalization and with what distributional impacts. Addresses specific sectoral issues and approaches to urban planning and policy in such areas as housing, climate change and hazard preparedness, economic development, transportation, and urban design and public space.

**PPUA 5266. Urban Theory and Science. (4 Hours)**

Studies the evolution of urban science, looking at some seminal theories that seeded the field and the subsequent work they inspired, including the methodologies developed to examine them. For over a century, social scientists and policymakers have sought to better understand cities, asking important theoretical questions, such as: What is a neighborhood? How does a city grow? What is a city in the first place? Culminates in an examination of urban science in the digital age, exploring how modern technological trends, including "big data," are posing new questions and offering new ways to answer them.

**PPUA 5267. Climate Policy and Justice. (4 Hours)**

Discusses key climate policy approaches, including market-based and regulatory approaches, as well as intersectional approaches that address underlying drivers of climate change. Climate change is one of the most pressing challenges facing society and requires policy responses across scales: locally, nationally, and globally. Introduces frameworks and tools for climate policy design, implementation, and evaluation, with an emphasis on considering how policies can promote justice. Case studies from US and international contexts will be used throughout the semester to explore policy design and implementation in practice. In addition to considering national and sub-national climate policy, covers legal, political, and economic issues in the international negotiations and addresses the history and current issues in international climate diplomacy.

**PPUA 5268. International Environmental Policy. (4 Hours)**

Explores key environmental challenges and policy solutions from an international perspective. Emphasizes the complexity of human-natural systems for policy design, provides a history of international environmental politics, and discusses contemporary policy issues. Presents key paradigms for understanding environmental challenges and the analytical tools to look critically at important debates, understand the role of different actors, identify equity and justice considerations, and assess policy options from multiple perspectives. Focuses on global environmental governance and sustainable development diplomacy, natural resource management, and climate change policy. Addresses the role of science in policymaking, tensions between environment and development, the scale and complexity of international environmental governance, and equity and justice.

**PPUA 5269. Social Policy: Design, Implementation, and Critique. (4 Hours)**

Offers a deep dive into some of the content and much of the history, mechanics, and implementation of various types of social policy. Students prioritize a single social policy area, which they examine in greater depth over the course of the semester, in addition to the broad breadth of social policies presented as part of the course. Uses course readings, fieldwork, networking, and tandem teaching to offer insight into what social policy actually is, the mechanics of how social policy is accomplished, key skills needed to execute both design and implementation of social policy, and methods of critique regarding the implementation of social policy.

**PPUA 5270. Food Systems and Public Policy. (4 Hours)**

Explores the public policy dimensions of the contemporary food system. Utilizes scholarly readings and case studies to assess the role of governing institutions and political actors in shaping the food supply; the effects of energy, transportation, and urban policies on food access; the ecological dimensions of food production; impacts of international trade regimes on global food trade; and the potential impacts of climate change on food security. Compares the United States and other nations and explores alternatives to the dominant food system. Seeks to engage students in applied policy analysis of specific food system issues.

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**PPUA 5390. Special Topics in Public Policy and Urban Affairs. (4 Hours)**

Covers special topics in public policy and urban affairs. Topics are selected by the instructor and vary from semester to semester. May be repeated up to three times for up to 12 total credits.

**PPUA 5976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**PPUA 5984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**PPUA 6101. Environmental Science and Policy Seminar 1. (4 Hours)**

Offers an integrated introduction to the intersection between environmental science and policy. Organized around the two central themes of sustainability transitions and climate resilience. Connects theoretical frameworks, including sociotechnical systems and coupled socioecological systems, to key science-policy issues related to transitioning to a more sustainable future and responding to a changing climate.

**PPUA 6201. The 21st-Century City: Urban Opportunities and Challenges in a Global Context. (4 Hours)**

Offers a multidisciplinary examination of the complexities of cities and urbanism in the 21st century. Focuses on U.S. cities, but in an international context. Considers forces that shaped the evolution of cities and metropolitan regions and global forces that are currently transforming cities and regions throughout the world. Explores key questions of urban well-being, rising racial and ethnic inequality, civic engagement, and sustainability. Focuses on the role of urban planning in creating conditions of racial segregation and environmental injustice in cities and its potential role in the current period in undoing this damage.

**PPUA 6212. Research Toolkit for Urban and Regional Policy: Project Management. (2 Hours)**

Introduces students to concepts of and tools used in project management as applied to urban and regional policy issues.

**PPUA 6216. Research Toolkit for Urban and Regional Policy: Grant Writing. (2 Hours)**

Seeks to prepare students to pursue grant-based funding from a variety of funding agencies and foundations. Offers students an opportunity to develop practical skills in proposal writing and budget development. Examines all aspects of the proposal-writing process, from identifying high-potential funding opportunities to writing and submitting proposals. Assignments offer students an opportunity to apply their learning to real-world interests.

**PPUA 6219. Race, Justice, and Belonging in Planning Practice. (2 Hours)**

Addresses issues of inclusion, citizenship, and social justice in urban planning, and explores issues of race, gender, and other forms of discrimination in planning practice. Examines how planners have interacted with historically marginalized communities in the United States and other contexts and the ways that these experiences have shaped community perspectives on the planning profession. Offers students an opportunity to analyze best practices in methods to engage communities in more just and equitable planning processes, explore experiences of race and other forms of difference within the planning profession, and examine practices for building and leading diverse and inclusive planning organizations.

**PPUA 6232. Designing Global Economic and Social Policy. (4 Hours)**

Examines economic challenges facing developing nations including poverty, inequality, low productivity, and limited access to human capital. Presents insights into theories like neoclassical growth models and dependency theory on spurring development. Explores policy options to promote growth such as increasing access to safety nets, human capital, and labor force participation. Offers students an opportunity to analyze data; evaluate policies to systematically understand developing world economic issues; and identify evidence-based, sustainable solutions tailored to individual countries' challenges.

**PPUA 6410. Urban Informatics Portfolio. (1 Hour)**

Guides urban informatics students through the process of developing a portfolio of professional-quality work. Requires students to submit a three-project portfolio developed from projects completed within courses taken as part of fulfilling the degree requirements. The projects must be presented in high-quality and concise visualizations and text.

**PPUA 6500. Principles of Public Administration. (4 Hours)**

Introduces students to concepts and approaches to analyzing significant factors and relationships in government agencies and public-oriented nongovernmental organizations as they function in their environments. Examines the legal and constitutional foundations of public administration, bureaucratic structure and administrative power, managerial accountability and ethics, human resource management, economics of organization, decision making, budgeting, implementation and "street-level" bureaucrats, and more recent developments in public administration such as performance management and public management networks.

**PPUA 6502. Economic Analysis for Policy and Planning. (4 Hours)**

Introduces the fundamentals of macroeconomics and microeconomics as well as the role of key economic institutions, such as the Federal Reserve. Includes analysis of government's role in a market economy and introduces methods of economic analysis.

**PPUA 6503. Managing People in Public and Nonprofit Sectors. (4 Hours)**

Introduces students to the human resources function from an individual and managerial standpoint. Studies various human resource management (HRM) activities, such as recruitment, selection, performance management, training and development, labor relations, and compensation. Applies the lens of strategic human resources management to foster a competent, motivated, and representative workforce.

**PPUA 6505. Public Budgeting and Financial Management. (4 Hours)**

Surveys governmental budgeting at the federal, state, and local levels. Surveys major revenue sources and expenditure responsibilities. Discusses budgetary processes and politics, as well as resulting policies. Considers both proposed and implemented reforms. Also introduces financial management practices including cash management, fund accounting, debt financing, endowment spending and control, cost allocation procedures, and tax expenditures.

**PPUA 6506. Techniques of Policy Analysis. (4 Hours)**

Provides a systematic approach to understanding the origins, formulation, implementation, and impact of government outputs. Reviews key analytical concepts and competing theoretical perspectives. Considers both the political dimensions of public policymaking and the technical aspects of program design within the natural history of the policymaking process. Draws on case materials from a spectrum of policy areas.

**PPUA 6507. Institutional Leadership and the Public Manager. (4 Hours)**

Examines the problems and techniques relevant to effective management of a public agency in a complicated and often turbulent political environment. Topics include legislative relations, media relations, role of the courts, unions and advocacy groups, policy implementation and evaluation, and setting and working with high standards of integrity.

**PPUA 6509. Techniques of Program Evaluation. (4 Hours)**

Reviews methodologies for assessing the impact of public policy. Includes experimental and quasi-experimental research design, the value and limits of case studies, political and organizational barriers to evaluation research, report writing, and procedures for instituting change.

**PPUA 6522. Administrative Ethics and Public Management. (4 Hours)**

Analyzes ethical problems in American public administration including discussion of ethical dilemmas frequently faced by public managers.

**PPUA 6530. State and Local Public Finance. (4 Hours)**

Analyzes the fiscal dimensions of state and local governments in the United States. Examines the types and ranges of tax and nontax revenues available to local and state governments and factors shaping the types of revenue sources utilized. Also assesses local and state government spending trends, use of public funds for economic development and other goals, impacts of federal mandates on local and state budgets, distinctions between operating and capital budgets, and the overall legal and political factors shaping public finance.

**PPUA 6532. Building Resilience into Local Government. (4 Hours)**

Focuses on often-overlooked management challenges facing local governments: preparing for, responding to, and recovering from disasters, whether natural or human-caused. While disaster planning typically focuses on first responders in fire and police departments, or on federal government agencies like FEMA, much less attention is paid to those local government leaders, from town managers to elected mayors and councilors, who are responsible for how their municipalities handle disaster. Considers what public leaders need to know about building their own capabilities and draws on cases and lessons from local government to build resilience into local communities.

**PPUA 6551. Nonprofit Organizations and Social Change. (4 Hours)**

Offers an overview of fundamental principles and practice in the nonprofit sector as they relate to social change. Topics include systems change and stakeholder identification, design thinking and human-centered design, theory of change and logic models, program design and evaluation, strategic and business planning, organizational structure and capacity building, governance, and communications and social media.

**PPUA 6552. The Nonprofit Sector in Civil Society and Public Affairs. (4 Hours)**

Examines the challenges facing the nonprofit sector, particularly as it relates to civil society and public policy concerns. Emphasizes current controversies in which the nonprofit sector is involved, such as the impact of changes in government spending and tax policy, the nature and legitimacy of nonprofit advocacy, the role of faith-based organizations in providing public services, accountability and oversight of nonprofit organizations, the growth of social entrepreneurship, and the work of nonprofits in fostering social capital and supporting civic engagement.

**PPUA 6553. Nonprofit Financial Management. (4 Hours)**

Presents a comprehensive overview of resource development and financial management in nonprofit organizations. Topics include fundraising and development planning, donor identification, nonprofit budgeting and financial reporting, investments and earned income for nonprofits, government contracting and grants, and importance of ethics and accountability in nonprofit management.

**PPUA 6554. NGO Management and International Development. (4 Hours)**

Examines the structures and functions of different types of non-governmental organizations and their growing and changing role in maintaining international peace and security, protecting human rights, and promoting economic development. Delves into thematic questions on NGO strategies, funding, ethical issues, interaction with governments, intended beneficiaries, multinational corporations, and other NGOs. Raises issues relating to human rights, women's rights, international development, and the external environment.

**PPUA 6861. Internship. (0 Hours)**

Offers students an approved public- or nonprofit-sector internship that fulfills academic degree requirements. Students must complete minimum internship work hours as defined by academic program. Supervising faculty assign a final integrative or reflective project. May be repeated up to two times.

**PPUA 6862. Internship with Research. (4 Hours)**

Offers students who wish to pursue additional directed reading and independent research related to the internship placement an approved public- or nonprofit-sector internship. Students must complete minimum internship work hours as defined by academic program. Research project is determined in consultation with faculty. Supervising faculty assign a final integrative or reflective project. May be repeated once for up to 6 total credits.

**PPUA 6954. Co-op Work Experience - Half-Time. (0 Hours)**

Provides eligible students with the opportunity for work experience. May be repeated without limit.

**PPUA 6955. Co-op Work Experience Abroad - Half-Time. (0 Hours)**

Provides eligible students with an opportunity for work experience abroad. May be repeated without limit.

**PPUA 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PPUA 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated twice.

**PPUA 6965. Co-op Work Experience Abroad. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated without limit.

**PPUA 6966. Practicum. (1-4 Hours)**

Provides eligible students with an opportunity for practical experience. May be repeated without limit.

**PPUA 6983. Topics. (4 Hours)**

Covers special topics in public policy and urban affairs. Topics are selected by the instructor and vary from semester to semester. May be repeated up to three times for up to 12 total credits.

**PPUA 7204. Seminar on Policy Theory. (4 Hours)**

Studies what it means to be a policy scientist, emphasizing a conceptual understanding of what policy is, how policies are designed, how they change over time, and the populations and institutions that the policies serve (or fail to serve). Examines how these and related questions have been explored both in classical theories and more recent extensions, focusing on how students can pursue a policy science rooted in theory.

**PPUA 7237. Advanced Spatial Analysis of Urban Systems. (4 Hours)**

Builds on skills covered in PPUA 5263. Offers students an opportunity to obtain greater depth in the analysis of urban spatial data focused on several urban systems (including social, built, and natural systems). Focuses on understanding the spatial relationships between various new and large urban datasets relevant to current policy challenges within cities. This is a project-based class.

**Prerequisite(s):** PPUA 5263 with a minimum grade of C- or PPUA 5263 with a minimum grade of D-

**PPUA 7346. Resilient Cities. (4 Hours)**

Examines the characteristics of resilient cities, especially those located in coastal regions. Investigates the capacity of cities to respond to major disruptions to their social and ecological systems. Includes extensive use of case studies, such as the 2004 Indian Ocean tsunami and Hurricane Katrina in 2005, as well as readings on cities and social systems. Offers students an opportunity to analyze an urban area and provide recommendations for improving its resilience. POLS 7346 and PPUA 7346 are cross-listed.

**PPUA 7521. Seminar in Urban Theory. (4 Hours)**

Introduces students to foundational debates in the study of cities, urbanization, and urban planning and policy. Presents a broad interdisciplinary understanding of cities and urbanization, addressing questions related to the spatial development of cities and regions, governance and politics, economics, and social change. Offers students an opportunity to understand the connections between urban policy research and social theory, including concepts from human geography, sociology, urban planning, economics, and political science. Students read and discuss seminal texts, including classical concepts in social theory and contemporary debates on topics such as globalization, segregation, gentrification, sustainability, inequality, and questions of race and gender in urban policy.

**PPUA 7673. Capstone in Public Policy and Urban Affairs. (4 Hours)**

Offers an opportunity for student teams, in partnership with a local, state, or federal agency or nonprofit institution, to assess an urban or regional problem, produce a thorough policy analysis, and present it and recommended solutions to the agency or institution. Course readings focus on materials needed to assess the problem and provide solutions. This is a faculty-guided team project for students completing course work in urban and regional policy studies. May be repeated without limit.

**PPUA 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PPUA 7973. Special Topics in the Social Sciences. (4 Hours)**

Examines selected topics in the social sciences and public policy. May be repeated up to two times.

**PPUA 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**PPUA 7990. Thesis. (1-6 Hours)**

Offers thesis supervision by members of the department. May be repeated without limit.

**PPUA 8960. Exam Preparation—Doctoral. (0 Hours)**

Offers the student the opportunity to prepare for the PhD qualifying exam under faculty supervision. May be repeated four times.

**PPUA 8966. Practicum. (1-4 Hours)**

Provides eligible students with an opportunity for practical experience. May be repeated without limit.

**PPUA 8986. Research. (0 Hours)**

Offers an opportunity to conduct full-time research under faculty supervision. May be repeated without limit.

**PPUA 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**PPUA 9980. Experiential PhD Research Residency. (0 Hours)**

Comprises a research residency experience in an organization whose mission and activities are aligned within the School of Public Policy and Urban Affairs. The research residency is designed to help develop dissertation ideas or research papers or to obtain access to resources helpful to dissertation development or research. A faculty member serves as an advisor for the residency experience, but individuals within the organization in which the student is working are asked to serve as formal mentors for the student residency experience. May be repeated two times.

**PPUA 9984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**PPUA 9990. Dissertation Term 1. (0 Hours)**

Offers dissertation supervision by individual members of the department.

**Prerequisite(s):** PPUA 9000 with a minimum grade of S

**PPUA 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** PPUA 9990 with a minimum grade of S

**PPUA 9996. Dissertation Continuation. (0 Hours)**

Offers continued dissertation supervision by individual members of the department.

**Prerequisite(s):** PPUA 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Public Relations (PREL)

**PREL 1425. Public Relations Principles. (4 Hours)**

Presents the principles, history, and methods of public relations; processes of influencing public opinion; responsibilities of the public relations practitioner; and analyses of public relations programs. Through case studies and class discussions, offers students an opportunity to confront real-life ethical dilemmas and learn to apply ethical frameworks to evaluate and resolve them.

**PREL 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PREL 2325. Influencing the Influencers. (4 Hours)**

Examines the evolving world of social media influencers and their impact on the practice of public relations. Explores how traditional media theories that shape public relations also apply when working with influencers; considers the pros and cons of working with influencers; and examines methods for assessing influencer audiences to determine how to use social media as part of communications programs. Studies how to engage directly with influencers of behalf of clients as well as examine the incentive structures that underpin influencer-client relationships.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Writing Intensive

**PREL 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PREL 3625. Public Relations Practice. (4 Hours)**

Demonstrates practices and techniques employed in the field including organization of events and functions. Studies campaign planning, research, and media relationships.

**Prerequisite(s):** JRNL 3425 with a minimum grade of D-

**PREL 3627. Critical Thinking About Public Relations Strategies. (4 Hours)**

Offers upper-level students from multiple disciplines an opportunity to take a microscopic view of how issues are purposefully driven by professionals interested in promoting causes, political candidates, public policy, and corporate image. Examines how corporations and others make decisions and which theories of institutional behavior best explain those choices. Are companies motivated solely by economics as Marx would argue, or do they approach their image in a more functional way? Are the messages of politicians determined by race and class, or do they respond to a different framework? Requires students to follow current issues and dissect significant past campaigns. Knowledge of public relations tactics is helpful but not necessary.

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**PREL 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PREL 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PREL 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Public Relations - CPS (PBR)****PBR 6001. Communications Technology Lab. (1 Hour)**

Focuses on the critical skill of using HubSpot to manage marketing communications. Marketing technology tools are the most in-demand skill set for marketers today. Introduces all key digital communications tools: content development, social media, PR, CRM, and email marketing. Offers students a weekly opportunity to build a comprehensive campaign that will become a portfolio piece, validating their experience with HubSpot to potential employers.

**PBR 6100. Introduction to Public Relations. (3 Hours)**

Introduces the ideas, skills, and principles that underlie the public relations craft. Designed for career changers and those new to public relations. Offers students an opportunity to study the role and contributions of public relations practitioners in contemporary society; to learn about potential legal and ethical aspects of the practice of public relations; to study the communication process and how persuasion is used with various audiences; and to learn how to develop a strategic communication plan to achieve specific goals and objectives. Also introduces students to specialized practice areas within the public relations field, such as business and industry, government, nonprofits and associations, and healthcare.

**PBR 6125. Community Relations and Corporate Social Responsibility. (3 Hours)**

Explores why corporate social responsibility and strong community relations are increasingly important elements of business strategy. Considers the factors that enable an organization to build relationships with the broader community within which it operates. Offers students an opportunity to develop a corporate social responsibility campaign as a signature assignment that incorporates ethical considerations and multimedia methods of delivery.

**PBR 6130. Public Relations Content Development. (3 Hours)**

Focuses on how to conceptualize and generate communications content in support of brand awareness and key organizational objectives. Offers students an opportunity to understand when and how to use different content approaches as part of communications outreach. Also offers them a chance to create common public relations products such as online display ads, media pitches, social media calendars and posts, and webpages and online videos.

**PBR 6135. Public Relations Strategy and Planning. (3 Hours)**

Examines the role and responsibilities of public relations professionals in promoting brand identity and organizational reputation as a key element in an organization's business strategy. Explores the skills and knowledge required for ensuring that strategic messages resonate with target audiences, both domestic and global. Offers students an opportunity to develop a strategic public relations strategy as a signature assignment.

**PBR 6140. Advanced Public Relations Content Development. (3 Hours)**

Constitutes an advanced course that offers students an opportunity to broaden and deepen their knowledge of different types of public relations content. Focuses on the characteristics of different PR products and how to use them to reach key audiences and prompt desired reactions. Offers students an opportunity to create such public relations products as an email promotion, an online news center, a blog, and event marketing materials.

**PBR 6710. Research: Understanding External Audiences. (3 Hours)**

Focuses on the important role of market research and the use of existing data to gain insights into the attitudes of a wide range of external stakeholders, including journalists, investors, and customers, as well as the role environmental conditions play in the overall media campaign process. Offers students an opportunity to gain in-depth knowledge of research steps—including surveys, focus groups, and psychographic data—and to identify and analyze attitudinal patterns in target audiences as the foundation for effective public and media relations campaign strategies.

**Prerequisite(s):** PBR 6100 (may be taken concurrently) with a minimum grade of C-

**PBR 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**PBR 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

## Regulatory Affairs - CPS (RGA)

**RGA 5000. Introduction to Food and Drug Administration (FDA) Pharmaceutical Regulation. (1.5 Hours)**

Offers an overview of biopharmaceutical product formulation, development, and commercialization regulation by the U.S. Food and Drug Administration (FDA) and other regulatory agencies. Through course work and didactic technical instruction, offers students an opportunity to develop the foundations necessary to build a strong scientific and technical understanding of biopharmaceutical design and commercialization compliance. Topics include the dynamic progression of U.S. biopharmaceutical laws, differentiation between law vs. regulation, FDA and industry compliance functions, policy-guided science, and cases that shape the evolution of regulatory compliance.

**RGA 5001. Introduction to Food and Drug Administration (FDA) Medical Device Regulation. (1.5 Hours)**

Offers an overview of the medical device engineering, development, and commercialization process and its regulation by the U.S. Food and Drug Administration (FDA). Through course work and didactic technical instruction, offers students an opportunity to develop an understanding of fundamental medical device regulatory affairs from a U.S.-centric perspective. Reviews the historical development of significant U.S. medical device legislation, including the Medical Device Amendments of 1976. Introduces the subject of quality system regulation (QSR) as it relates to device product design, clinical development, operations management, and compliance.

**RGA 5002. Introduction to Regulatory Compliance and Practice. (1.5 Hours)**

Presents a detailed overview of critical scientific, technical, engineering design, manufacturing, and operational drivers for regulatory compliance. Offers students an opportunity to gain competencies in the areas of regulatory agency, advocacy, ethics, mitigation laws, and corporate compliance responsibility. A study of the various state, federal, and international agencies, their authorities, and how they became established is designed to enable students to understand the scientific and technical scope of the global regulatory compliance landscape.

**RGA 5101. Therapeutic Product Development: A Regulatory Overview. (3 Hours)**

Examines every step of the biotherapeutic development and regulation process within the U.S. FDA's Center for Biologic Evaluation and Research (CBER) and Center for Drug Evaluation and Research (CDER). Enrolled students receive didactic instruction from product formulation, product development, and preclinical testing perspectives through postmarketing adverse experience reporting. Offers students an opportunity to study FDA standards for nonclinical testing-quality assurance issues and good laboratory practice, investigational new drug (IND) applications, therapeutic market applications and review processes designed to speed therapeutic product review, as well as current good manufacturing practice and operations management regulations.

**Prerequisite(s):** RGA 5000 with a minimum grade of C-

**RGA 5202. Medical Device Development: A Regulatory Overview. (3 Hours)**

Analyzes U.S. medical device engineering development, marketing approval, and commercialization compliance requirements from scientific, technical, and engineering-based perspectives. Features analysis of quality assurance issues and recent regulatory reforms implemented under the Food and Drug Modernization Act (FDAMA). Provides a step-by-step guide through the Center for Devices and Radiological Health (CDRH). Covers CDRH's reengineering initiatives and evolving investigational device exemptions, premarket approval, 510(k) application process, and product development protocol and review processes. Offers practical, in-depth analyses and didactic instruction on how emerging technical trends and the application of statistical modeling to analyze product complaints are reshaping medical device regulation in the United States. Offers students an opportunity to learn how to think critically about the interaction between regulatory and development processes.

**RGA 5203. Pharmaceutical and Medical Device Law: Topics and Cases. (3.75 Hours)**

Analyzes current food, drug, and medical device laws. Reviews legislation and landmark cases, as well as laws governing formulation development, engineering design, manufacture, and commercial distribution of drugs, biologics, and medical device products. Studies how these variables relate to operations management in the biotechnology, pharmaceutical, and medical device industries.

**RGA 5204. Legal Issues in International Food, Drug, and Medical Device Regulation. (3.75 Hours)**

Explores international laws related to the regulation of food, drugs, and medical devices with a focus on the European Union. Draws comparisons between international laws and corresponding U.S. laws, as well as considerations necessary for international biotechnology, pharmaceutical, and medical device industries.

**RGA 5212. Introduction to Safety Sciences. (3 Hours)**

Introduces safety and surveillance regulations and principles for products developed and commercialized in regulated industries. Covers global safety regulations as well as related guidance from agencies such as the FDA, International Conference on Harmonization (ICH), the World Health Organization (WHO), and the European Commission (EC). Adopts a life-cycle perspective, beginning with use of precommercialization data to anticipate human safety issues, and continuing through prototype development and postmarketing issues. Offers students an opportunity to review combination products; safety information in regulatory documents (for example, INDs, clinical study reports, NDA submissions); safety data analysis; quality management and CAPAs; safety plans; and global safety initiatives (e.g., the General Data Protection Regulation).

**RGA 5463. Regulatory Strategy for Product Development and Life-Cycle Management. (3 Hours)**

Examines the preparation of regulatory strategies to support product development and life-cycle management while providing students the opportunity to examine domestic and international processes relevant to regulatory strategy. In developing target product profiles, strategic regulatory plans, and life-cycle management plans, students appraise key components of regulatory strategies, evaluate core elements of product life cycle in the generation of those strategies, and integrate business needs into regulatory planning. Upon completion of the course, successful students should possess the fundamentals to formulate regulatory strategies supporting product development and life-cycle management and be equipped with a stronger understanding of the high-visibility role regulatory professionals serve in developing sound regulatory strategy.

**RGA 6000. Introduction to Food and Drug Administration (FDA) Pharmaceutical Regulation. (2 Hours)**

Offers an overview of biopharmaceutical product formulation, development, and commercialization regulation by the U.S. Food and Drug Administration (FDA) and other regulatory agencies. Through course work and didactic technical instruction, offers students an opportunity to develop the foundations necessary to build a strong scientific and technical understanding of biopharmaceutical design and commercialization compliance. Topics include the dynamic progression of U.S. biopharmaceutical laws, differentiation between law vs. regulation, FDA and industry compliance functions, policy-guided science, and cases that shape the evolution of regulatory compliance.

**RGA 6001. Introduction to Food and Drug Administration (FDA) Medical Device Regulation. (2 Hours)**

Offers an overview of the medical device engineering, development, and commercialization process and its regulation by the U.S. Food and Drug Administration (FDA). Through course work and didactic technical instruction, offers students an opportunity to develop an understanding of fundamental medical device regulatory affairs from a U.S.-centric perspective. Reviews the historical development of significant U.S. medical device legislation, including the Medical Device Amendments of 1976. Introduces the subject of quality system regulation (QSR) as it relates to device product design, clinical development, operations management, and compliance.

**RGA 6002. Introduction to Regulatory Compliance and Practice. (2 Hours)**

Presents a detailed overview of critical scientific, technical, engineering design, manufacturing, and operational drivers for regulatory compliance. Offers students an opportunity to gain competencies in the areas of regulatory agency, advocacy, ethics, mitigation laws, and corporate compliance responsibility. A study of the various state, federal, and international agencies, their authorities, and how they became established is designed to enable students to understand the scientific and technical scope of the global regulatory compliance landscape.

**RGA 6101. Therapeutic Product Development: A Regulatory Overview. (4 Hours)**

Examines every step of the biotherapeutic development and regulation process within the U.S. FDA's Center for Biologic Evaluation and Research (CBER) and Center for Drug Evaluation and Research (CDER). Enrolled students receive didactic instruction from product formulation, product development, and preclinical testing perspectives through postmarketing adverse experience reporting. Offers students an opportunity to study FDA standards for nonclinical testing-quality assurance issues and good laboratory practice, investigational new drug (IND) applications, therapeutic market applications and review processes designed to speed therapeutic product review, as well as current good manufacturing practice and operations management regulations.

**Prerequisite(s):** RGA 6000 with a minimum grade of C- ; BTC 6210 with a minimum grade of C-

**RGA 6202. Medical Device Development: A Regulatory Overview. (4 Hours)**

Analyzes U.S. medical device engineering development, marketing approval, and commercialization compliance requirements from scientific, technical, and engineering-based perspectives. Features analysis of quality assurance issues and recent regulatory reforms implemented under the Food and Drug Modernization Act (FDAMA). Provides a step-by-step guide through the Center for Devices and Radiological Health (CDRH). Covers CDRH's reengineering initiatives and evolving investigational device exemptions, premarket approval, 510(k) application process, and product development protocol and review processes. Offers practical, in-depth analyses and didactic instruction on how emerging technical trends and the application of statistical modeling to analyze product complaints are reshaping medical device regulation in the United States. Offers students an opportunity to learn how to think critically about the interaction between regulatory and development processes.

**Prerequisite(s):** BTC 6210 (may be taken concurrently) with a minimum grade of C- ; RGA 6001 (may be taken concurrently) with a minimum grade of C-

**RGA 6203. Pharmaceutical and Medical Device Law: Topics and Cases. (5 Hours)**

Analyzes current food, drug, and medical device laws. Reviews legislation and landmark cases, as well as laws governing formulation development, engineering design, manufacture, and commercial distribution of drugs, biologics, and medical device products. Studies how these variables relate to operations management in the biotechnology, pharmaceutical, and medical device industries.

**Prerequisite(s):** RGA 6101 (may be taken concurrently) with a minimum grade of C- or RGA 6202 (may be taken concurrently) with a minimum grade of C-

**RGA 6204. Legal Issues in International Food, Drug, and Medical Device Regulation. (5 Hours)**

Explores international laws related to the regulation of food, drugs, and medical devices with a focus on the European Union. Draws comparisons between international laws and corresponding U.S. laws, as well as considerations necessary for international biotechnology, pharmaceutical, and medical device industries.

**Prerequisite(s):** RGA 6101 (may be taken concurrently) with a minimum grade of C- or RGA 6202 (may be taken concurrently) with a minimum grade of C-

**RGA 6205. Emerging Trends and Issues in the Medical Device Industry. (4 Hours)**

Focuses on trends expected to have a significant effect on the future of the medical device industry, including the aging population; the need for devices that treat chronic illnesses such as renal failure, congestive heart failure, heart abnormalities, arthritis, and diabetes; reimbursement issues arising from the huge financial burden placed on Medicare and insurance companies in picking up the increased cost of healthcare; lifestyle changes with an increased demand for devices that improve one's quality of life or appearance; reuse of single-use disposable devices to cut costs; group purchasing practices, outpatient treatment; telemedicine, regulatory/legal requirements; and the movement of devices into new areas, such as coating stents with pharmaceutical/biological agents and using patches to deliver pharmaceutical agents.

**Prerequisite(s):** RGA 6202 with a minimum grade of C-

**RGA 6207. Global Impact of Electronic Common Technical Document (eCTD) Submissions. (4 Hours)**

Examines the structure of the Common Technical Document (CTD) format through study of both regulatory requirements as well as example submissions. Offers students an opportunity to develop an understanding of FDA's geographically specific eCTD submission requirements. Students review and receive didactic instruction in the basic structure and technical format of an eCTD submission, the use of statistical models to present data, and the differences between the electronic format and former paper-based CTD submissions.

**Prerequisite(s):** RGA 6101 with a minimum grade of C- ; BTC 6210 with a minimum grade of C-

**RGA 6210. Strategic Planning and Project Management for Regulatory Affairs. (4 Hours)**

Introduces the core concepts of strategic planning and project management. Seeks to equip regulatory professionals with the skills needed to join upper corporate management in choosing which products to pursue and how best to pursue them. Offers students an opportunity to learn how to guide medical device teams through the design and development stages. Emphasizes the role of product classifications in demonstrating the safety, efficacy, and performance of medical devices for human use. The curriculum and assignments offer a chance to carefully study the function and format of presubmission meetings with U.S. and other global regulatory agencies, as well as understand their role in gaining regulatory approval for market sale.

**Prerequisite(s):** RGA 6202 with a minimum grade of C- or RGA 6101 with a minimum grade of C-

**RGA 6212. Introduction to Safety Sciences. (4 Hours)**

Introduces safety and surveillance regulations and principles for products developed and commercialized in regulated industries. Covers global safety regulations as well as related guidance from agencies such as the FDA, International Conference on Harmonization (ICH), the World Health Organization (WHO), and the European Commission (EC). Adopts a life-cycle perspective, beginning with use of precommercialization data to anticipate human safety issues, and continuing through prototype development and postmarketing issues. Offers students an opportunity to review combination products; safety information in regulatory documents (for example, INDs, clinical study reports, NDA submissions); safety data analysis; quality management and CAPAs; safety plans; and global safety initiatives (e.g., the General Data Protection Regulation).

**Prerequisite(s):** RGA 6002 with a minimum grade of C- ; RGA 6463 with a minimum grade of C-

**RGA 6215. Project Management in Early Drug Discovery and Development. (4 Hours)**

Provides an overview of the processes common to researching and developing a new drug. Focuses on the early stages of this progression, from identifying active molecules to completing Phase 1 safety trials. Surveys the predominant biological and chemical techniques used in these efforts. Offers students an opportunity to prepare standard operating procedures and a pre-IND package. The lectures and reading materials focus on how to incorporate key data in writing the IND. Examines the procedures used to execute a Phase 1 safety study and the strategies available to prepare a persuasive clinical study report. Throughout the term, course material highlights the applicability and utility of project management tools.

**Prerequisite(s):** RGA 6101 with a minimum grade of C- or RGA 6202 with a minimum grade of C-

**RGA 6217. Biomedical Product Development: From Biotech to Boardroom to Market. (4 Hours)**

Examines the evolution of the medical device and pharmaceutical landscape from a technological, regulatory, and financial perspective, as well as from a societal and cultural framework. Begins by recognizing that significant differences exist between small and mid-to-large medical device and pharmaceutical companies with regard to key variables in the current business environment. These differences extend to the opportunities available as well as the limitations and challenges faced by each. Discusses the symbiotic and potentially synergistic relationship that has developed between small, yet established, biotechnology companies and large medical device and pharmaceutical firms, as well as the impact of these relationships on the general economic environment.

**Prerequisite(s):** RGA 6101 with a minimum grade of C- or RGA 6202 with a minimum grade of C-

**RGA 6219. Advanced Topics in Advertising and Promotion of Drugs and Medical Devices. (4 Hours)**

Covers current trends, regulations, and issues in digital advertising, including mobile applications, social media, and Twitter; FDA's and FTC's role in the regulation of OTC products and certain mobile digital applications; patient engagement; FDA regulation of advertising and promotion of veterinary drugs; recent FDA and government enforcement actions and court cases; proactive communications about medical products between manufacturers and payers, including use of real-world evidence; global perspective on regulation of advertising and promotion, including Canada, Latin America, Asia, and the European Union; decision making and risk assessments in advertising and promotion.

**Prerequisite(s):** RGA 6101 with a minimum grade of C- or RGA 6202 with a minimum grade of C-

**RGA 6221. European Union Compliance Process and Regulatory Affairs. (4 Hours)**

Provides a clear-cut picture of the European Union (EU) and how EU directives impact international business. By illustrating how companies need to approach compliance, offers students an opportunity to be guided through compliance issues and to gain an understanding of the relationship between compliance and CE marking. Discusses the risks and rewards of CE marking and an overview of liability laws in the EU.

**Prerequisite(s):** RGA 6203 with a minimum grade of C- or RGA 6204 with a minimum grade of C-

**RGA 6222. European Medical Device Regulations. (4 Hours)**

Covers European Commission directives and guidance documents; European Agency for the Evaluation of Medicinal Products, medical device guidance documents, and notified body guidelines and recommendations; Global Harmonization Task Force final reports; and mutual recognition agreements. Topics include biological and biotechnological products, CE marking, conformity assessment and notified bodies, the Global Harmonization Task Force, clinical trials, and standardization.

**Prerequisite(s):** RGA 6203 with a minimum grade of C- or RGA 6204 with a minimum grade of C-

**RGA 6223. Introduction to Australian, Asian, and Latin American Regulatory Affairs. (4 Hours)**

Covers the applicable regulatory agency guidance and GMPs associated with biopharmaceutical and medical device product design, quality assurance, and commercialization specifically in Australia, Asia, and Latin America. Examines multinational documents from Asia-Pacific Economic Cooperation (APEC), Association of Southeast Asian Nations (ASEAN), MERCOSUR, and Pan American and World Health Organizations. Discusses Latin American government regulations and guidance, as well as the guidance and regulations from the General Agreement on Tariffs and Trade (GATT/WTO).

**Prerequisite(s):** RGA 6101 with a minimum grade of C- or RGA 6202 with a minimum grade of C-

**RGA 6224. Regulation of Biomedical Product Commercialization by Health Canada. (4 Hours)**

Studies the regulatory requirements associated with all phases of biomedical product commercialization in the Canadian market by manufacturers. The Canadian market represents a significant opportunity for biomedical product manufacturers to export their goods into foreign geographies. Several factors have led patients in Canada to seek treatment modalities for their clinical symptoms and disease from both Canadian and non-Canadian sources. Reviews the Common Technical Document format for market approval applications, general Health Canada Guidances, good manufacturing practices (GMPs), and Global Harmonization Task Force documents. Examines multinational requirements and recommendations, including those issued by the North American Free Trade Agreement, the World Health Organization, and the U.S. Food and Drug Administration. Reviews the requirements of submissions to Health Canada by biomedical product manufacturers.

**Prerequisite(s):** RGA 6202 with a minimum grade of C- or RGA 6101 with a minimum grade of C-

**RGA 6228. Managing International Clinical Trials. (4 Hours)**

Focuses on initiating, collecting, and managing data from multicountry clinical trials. The assigned material documents the growing internationalization of clinical research in biomedicine. For example, even trials carried out under the aegis of the U.S. FDA are likely to involve investigators in the European Union, China, India, Africa, or Latin America. The global nature of this research is due to the advantages that certain countries offer, including lower costs, flexible health infrastructures, and the presence of treatment-naïve populations. Multisource studies, however, present their own practical, legal, and ethical challenges. Offers students an opportunity to study the steps needed to conduct regulatory-compliant international trials. Through case studies and group projects, examines strategies to integrate clinical sites along common protocols and deadlines.

**Prerequisite(s):** BTC 6210 with a minimum grade of C-

**RGA 6233. Application of Quality System Regulation in Medical Device Design and Manufacturing. (4 Hours)**

Introduces the Food and Drug Administration's (FDA) Quality System Regulations (QSRs) and describes how these regulations can improve the safety and efficacy of medical device products. Discusses the legislative origins of QSRs, their historical evolution, as well as the details of how they are implemented. Examines case studies and empirical examples of QSRs that have been employed by individual medical device manufacturers during the product commercialization process. Offers students an opportunity to develop an understanding of FDA's expectations for product design control; the structuring of quality system documentation; and principles of practical QSRs within the context of medical device manufacturing, packaging, and distribution. Encourages students to develop strategies for customizing QSRs to particular companies, device products, and manufacturing environments.

**Prerequisite(s):** RGA 6101 with a minimum grade of C- or RGA 6202 with a minimum grade of C-

**RGA 6234. Risk Management: Compliance and Processes. (4 Hours)**

Seeks to provide a comprehensive overview of current risk-management practices, including supply chain management, as well as their impact on safety, product quality, and effectiveness. Analyzes regulatory oversight guidance documents, demonstrates how organizations in regulated sectors strive to ensure compliance, and discusses the responsibilities of regulatory professionals in supply chain risk-management systems. Studies the regulatory issues that originate from poor supplier performance and management. Using case-based investigations and real-world examples, analyzes how to evaluate risk-management systems as they relate to particular categories of regulated products manufactured in specific contexts. Offers students an opportunity to obtain the skills and knowledge they need to customize effective risk-management methods within various global settings.

**Prerequisite(s):** RGA 6000 with a minimum grade of C- or RGA 6001 with a minimum grade of C-

**RGA 6235. Emerging Product Categories in the Regulation of Drugs and Biologics. (4 Hours)**

Examines the development and commercialization pathways for several product categories, including new over-the-counter (OTC) products, neutraceuticals, nanotechnology products, and personalized medicine-based therapies. These emerging categories of drug and biologic products are not formally classified by FDA from a regulatory perspective. Evaluates the reasons why the regulatory paradigms for these products are not well established and analyzes how the relatively amorphous nature of these paradigms has impacted commercialization of these product categories in the U.S. market. Offers students an opportunity to gain a better understanding of how and why new product categories continue to emerge as existing regulatory classifications continue to evolve.

**Prerequisite(s):** RGA 6101 with a minimum grade of C- or RGA 6202 with a minimum grade of C-

**RGA 6243. Medical Device Product Development in Canada. (4 Hours)**

Explores the general requirements for medical device regulation globally and the details of medical device regulation in Canada. Familiarizes students with the International Medical Device Regulatory Forum goals and objectives, and explores the medical device regulatory model developed by Global Harmonization Task Force that is in use in many countries today. Studies the Canadian medical device regulations, covering topics such as postmarket topics of adverse event reporting, recalls and inspections, classification, device licensing, establishment registration, design change, license amendments, and annual renewal processes. Explores the use of standards globally and in Canada related to the regulation of medical devices. Offers students a project-based learning opportunity to learn how to prepare portions of a sample submission for Canada.

**Prerequisite(s):** RGA 6001 with a minimum grade of C- or RGA 6202 with a minimum grade of C-

**RGA 6244. Therapeutic Product Development in Canada. (4 Hours)**

Examines every step of the Canadian drug development and regulation process, from preclinical testing through postmarketing drug adverse reaction (DAR) reporting. Considers Canadian standards for nonclinical testing-quality assurance issues and good laboratory practice, good clinical practices, GMP, and use of ICH guidelines. Examines various Canadian drug submissions and their timelines, including New Drug Submission (NDS), Abbreviated New Drug Submission (ANDS), and Clinical Trial Applications (CTA).

**Prerequisite(s):** RGA 6002 with a minimum grade of C-

**RGA 6250. Financing and Reimbursement in Biomedical Product Development. (4 Hours)**

Introduces the complex discipline of market access and pricing strategy for medical device, drug, and biologic products. As cost and relative efficacy drivers become increasingly important to market biomedical products successfully, life-sciences regulatory professionals must evaluate regulatory compliance criteria in relation to reimbursement and product pricing concerns. Regulatory professionals must also be involved in demonstrating that utilization of new biomedical products is comparatively cost-effective when measured against standards of clinical care. Using specific case studies from the United States and abroad, offers students an opportunity to analyze these market developments, as well as their resulting implications for biomedical product development, manufacturing, and commercialization, with an overall objective to develop comparatively and financially informed regulatory systems.

**Prerequisite(s):** RGA 6101 with a minimum grade of C- or RGA 6202 with a minimum grade of C-

**RGA 6275. Product Development and Process Validation. (2 Hours)**

Studies the compliance standards associated with commercializing new biopharmaceutical and medical device products. Focuses on U.S. regulations, although discusses compliance with standards in other major geographical areas as well, including those in Canada and the European Union. Offers practical instruction in the product design control process, setup of small-batch manufacturing processes, scale-up to large-scale manufacturing processes, as well as the regulatory requirements for manufacturing process validation. Includes a detailed analysis of process flow, incoming raw material and work-in-progress testing, stability testing, sterility testing, and handling requirements. Other topics include creation of design history files, establishment of master validation plans, and compliance with ongoing facility and manufacturing equipment standards.

**Prerequisite(s):** RGA 6002 with a minimum grade of C- ; (RGA 6000 with a minimum grade of C- or RGA 6001 with a minimum grade of C- )

**RGA 6300. Practical Applications in Global Regulatory Affairs. (4 Hours)**

Offers students an opportunity to exercise their ability to translate global regulatory requirements for globally regulated product commercialization into submission-ready documents and broadly applicable regulatory science solutions. Uses didactic instruction and a series of practical exercises and discussions. Topics include creating practical documents based on regulations and guidelines, formulation development, completing production batch records, conducting product testing, performing inspections, and effective utilization of GxP requirements. Incorporates both group and/or individual assignments that require students to research applicable regulatory and industry information, as well as activities designed to aid in the comprehension of global regulatory issues. Uses case-based methodologies to enable real-world scientific and technical application of topics and regulatory issues discussed during the course.

**Prerequisite(s):** RGA 6203 with a minimum grade of C- or RGA 6204 with a minimum grade of C-

**RGA 6370. Advanced Regulatory Writing: Medical Device Submissions. (4 Hours)**

Examines the process of writing medical device submissions for regulatory agencies both nationally and internationally. Topics include device regulations, the device development process, and clinical study documents. Offers students an opportunity to practice communicating complex scientific information in various documents, including investigators' brochures, clinical trial reports, and investigational device exemption (IDE) 510(k) submission components.

**Prerequisite(s):** RGA 6202 with a minimum grade of C-

**RGA 6380. Advanced Regulatory Writing: New Drug Applications. (4 Hours)**

Examines the process of writing drug submissions for regulatory agencies both nationally and internationally. Topics include drug regulations, the drug development process, and clinical study documents. Offers students an opportunity to practice communicating complex scientific information in various documents, including investigators' brochures, clinical trial reports, and Investigational New Drug (IND) application submission components.

**Prerequisite(s):** RGA 6101 with a minimum grade of C-

**RGA 6405. Nonclinical Regulations in Biomedical Product Commercialization. (4 Hours)**

Examines the nonclinical regulatory processes involved in commercializing biomedical products within FDA's CBER, CDER, and CDRH. Offers students an opportunity to conduct a comprehensive analysis of FDA's quality standards for biomedical products, including gene and cellular-based therapies, with respect to ICH Common Technical Document (CTD) Module 4. Provides an overview of preclinical investigational new drug (IND) requirements and good manufacturing practice (GMP) regulations that must be fulfilled by biomedical product manufacturers in support of CTD Module 3.

Additionally, offers students an opportunity to study biocompatibility testing requirements for medical devices according to FDA guidance and ISO 10993 standards to support 510(k) and PMA submissions.

**Prerequisite(s):** RGA 6002 with a minimum grade of C- ; RGA 6463 with a minimum grade of C-

**RGA 6410. Fundamentals of CMC Regulations and Methods. (4 Hours)**

Discusses components of the Common Technical Document Module 3 and describes how regulatory affairs professionals support compliance with CMC regulation. Offers students an opportunity to design and evaluate core elements of an effective CMC compliance strategy, ensuring alignment with ICH guidelines, FDA Guidances, pharmacopeia, and 21 CFR. Chemistry, manufacturing, and controls (CMC) regulatory affairs professionals must use technical, analytical expertise and problem-solving abilities to ensure only quality product is distributed to patients.

**Prerequisite(s):** RGA 6101 with a minimum grade of C- or RGA 6202 with a minimum grade of C-

**RGA 6420. Global IVD Regulations and Submissions. (4 Hours)**

Examines in-depth regulations governing in vitro diagnostic medical devices. Covers the IVD regulations for the four major economic markets—United States, European Union, Australia, and Canada—as well as other markets that have specific IVD regulations—these countries could include China, Brazil, Mexico, etc. Topics include IVD classification schemes, regulatory strategy, regulatory submission routes (including harmonization), regulatory review processes, performance evaluation, clinical trial requirements, labeling, and postmarketing. Also explores IVD testing methodologies. Covers emerging trends in IVDs, such as the advent of companion diagnostics and their relationship to personalized medicine.

**Prerequisite(s):** RGA 6202 with a minimum grade of C

**RGA 6432. Real-World Evidence in Biomedical Research. (2 Hours)**

Provides an overview of real-world evidence (RWE), discusses challenges in implementing an effective RWE strategy, and reviews the implications of RWE on regulatory decision making. Topics include observational studies/pragmatic clinical trials, comparative effectiveness research, registries, patient reported outcomes, primary vs. secondary data collection, medical claims and electronic health record data, social media, wearable devices, and artificial intelligence.

**Prerequisite(s):** BTC 6210 with a minimum grade of C ; (RGA 6101 with a minimum grade of C or RGA 6000 with a minimum grade of C )

**RGA 6461. Cybersecurity and Regulation of Digital Health Technologies by the FDA. (2 Hours)**

Explores the increasing reliance on electronically based media to warehouse patient clinical data, as well as the need to protect it and maintain individual privacy with respect to patient healthcare data. Includes detailing the specifics of what types of patient clinical data new cybersecurity compliance regulations are designed to address, as well as a study of how these regulations impact the development of new biomedical products. Offers students an opportunity to study how these issues are addressed in other geographies, including the European Union, Canada, and the Asia-Pacific nations.

**Prerequisite(s):** RGA 6101 with a minimum grade of C- or RGA 6202 with a minimum grade of C-

**RGA 6463. Regulatory Strategy for Product Development and Life-Cycle Management. (4 Hours)**

Examines the preparation of regulatory strategies to support product development and life-cycle management while providing students the opportunity to examine domestic and international processes relevant to regulatory strategy. In developing target product profiles, strategic regulatory plans, and life-cycle management plans, students appraise key components of regulatory strategies, evaluate core elements of product life cycle in the generation of those strategies, and integrate business needs into regulatory planning. Upon completion of the course, successful students should possess the fundamentals to formulate regulatory strategies supporting product development and life-cycle management and be equipped with a stronger understanding of the high-visibility role regulatory professionals serve in developing sound regulatory strategy.

**RGA 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**RGA 6980. Capstone: Practical Applications in Global Regulatory Affairs. (1-4 Hours)**

Offers students an opportunity to integrate their course work, knowledge, and experiences into a capstone project.

**RGA 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions.

**RGA 7983. Topics. (1-4 Hours)**

Covers special topics in regulatory affairs. May be repeated without limit.

**Regulatory Affairs of Food - CPS (RFA)****RFA 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**RFA 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**RFA 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**RFA 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**RFA 6350. Political, Social, and Economic Influences on Food Law, Regulation, and Policy. (3 Hours)**

Analyzes the food legal landscape, specifically the political, social, and economic influences that shape food regulations, laws, and policies. Offers students an opportunity to apply current case law to contemporary situations with topics that intersect with various themes present throughout core and elective courses.

**Prerequisite(s):** RFA 6235 (may be taken concurrently) with a minimum grade of C-

**RFA 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**RFA 7995. Project. (1-4 Hours)**

Focuses on an in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated up to five times for up to 24 total credits.

## Remote Sensing - CPS (RMS)

**RMS 5105. Fundamentals of Remote Sensing. (3 Hours)**

Introduces remote sensing principles, datasets, and basic interpretation/analysis. Covers four general categories: physical processes/theories involved in remote sensing, e.g., the nature and properties of electromagnetic radiation and how it is affected by interactions with the atmosphere and earth's surface; different sensor types and platforms, including optical, thermal, and microwave systems, from UAVs to environmental satellites; different applications of remote sensing such as land-use, land-change, vegetation, natural hazards, precision agriculture, and military; and starting methods of remote sensing to analyze images and extract desired information. Software used includes ArcGIS Pro, ArcGIS Online, GIMP, and FOSS.

**RMS 6110. Introduction to Machine Learning for Image Data. (3 Hours)**

Explores a range of machine learning routines, including image classifications and clustering, PCAs, and data reduction. Students perform exercises corresponding to concepts introduced in weekly lessons. Focuses on computer thinking, algorithms involved in preprocessing, spectral and spatial enhancement, spatial analysis, and linear transformations. Utilizes a variety of data types and an opportunity to experience the journey of geospatial image data from its origin (raw data) to its end (transformation) in the context of the process, scope, and real-world scenarios. Examples provided with GBDX notebooks and customized work flows as entry to Python, cloud-based analytics, and web-based GUI software: ENVI, ArcGIS, and GBDX.

**Prerequisite(s):** RMS 5105 (may be taken concurrently) with a minimum grade of C-

**RMS 6240. Introduction to Radar and LiDAR Remote Sensing. (3 Hours)**

Introduces the techniques and methods of active imaging used in radar and Light Detection and Ranging (LiDAR). Covers the underlying principles of the measurement techniques and the interaction of microwaves and LiDAR signals with natural surfaces and the atmosphere. Regarding radar, the course focuses on the role of synthetic aperture radar (SAR) systems and their application to monitoring aspects of the Earth's surface, including 3-D. Regarding LiDAR, the course introduces the different airborne and satellite systems and applications in terrestrial surfaces, principally for urban applications. Students complete a weekly lab project related to the processing and analysis of these data. Software: ArcGIS; ENVI; LIDAR Analyst; ESA SNAP Toolbox; ASF MapReady; ASF SAR Training Processor; USDA FS FUSION; FugroViewer.

**Prerequisite(s):** RMS 5105 (may be taken concurrently) with a minimum grade of C-

**RMS 6280. Automated Feature Extraction for the Geospatial Professional. (3 Hours)**

Introduces machine learning and automated feature extraction software and how it is utilized for image interpretation. Explores a variety of techniques and work flows associated with collecting features of interest from multiple data sources, e.g., aerial and satellite imagery, LiDAR, and elevation data. Students use AFE software to solve real-world problems in exercises corresponding to concepts introduced in weekly lessons. Offers students an opportunity to learn how to use feature extraction to create industry-standard analytical products and develop processing models for automation. Discusses the fundamentals of machine learning, supervised and unsupervised classification, hierarchical learning, postprocessing, cleanup, automation, modeling, and publication. Software: Esri ArcGIS 10.5; Feature Analyst for ArcGIS; LIDAR Analyst; ENVI; ENVILiDAR.

**Prerequisite(s):** RMS 5105 with a minimum grade of C-

**RMS 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**RMS 6983. Topics. (1-4 Hours)**

Covers special topics in remote sensing. May be repeated without limit.

## Respiratory Therapy - CPS (RPT)

**RPT 6970. Seminar. (1-4 Hours)**

Offers an in-depth study of selected topics.

**Prerequisite(s):** RPT 7205 with a minimum grade of C- ; RPT 7210 with a minimum grade of C-

**RPT 7200. Advanced Cardiopulmonary Physiology. (4 Hours)**

Covers advanced in-depth integrated physiology of the cardiovascular, renal, and pulmonary systems. Discusses the physiological dynamics, control mechanisms, and system interrelationships of the cardiovascular, pulmonary, and renal systems. Offers students an opportunity to make applications of advanced cardiopulmonary and renal physiology concepts to the management of neonatal, pediatric, adult, and geriatric patients requiring cardiovascular, pulmonary, and renal diagnosis and treatment.

**RPT 7210. Research Design. (4 Hours)**

Covers different types of designs used in medical research. Emphasizes the evaluation of research designs in peer-reviewed medical journals. Discusses the quality of published research articles and evaluation of levels of evidence produced by clinical research. Attention is given to review of medical literature to identify evidence for current or new standards of practice. Discusses development of research protocols, proposals for research funding, and the management of research projects.

**RPT 7215. Applied Research in Respiratory Care. (4 Hours)**

Offers a review and discussion of student research protocols and data analysis. Discusses how to prepare research abstracts, posters, and manuscripts under the guidance of departmental faculty. Integrates research outcomes to support clinical practice.

**Prerequisite(s):** RPT 7210 with a minimum grade of C-

**RPT 7305. Development of Patient Management Plans. (4 Hours)**

Offers students an opportunity to use previously acquired knowledge and assessment skills to prepare respiratory care plans for those experiencing respiratory and respiratory-related disorders commonly encountered by the respiratory therapist. Includes how to evaluate outpatient and emergency department patients for home treatment; care plan development, including for patients with rehospitalization; rapid response team activation; or admission to ICU. Topics include concepts of respiratory and respiratory-related illnesses. Offers students an opportunity to learn how to make informed decisions about diagnostic and therapeutic interventions based on patient information and preferences, up-to-date scientific evidence, and clinical judgment (evidence-based practice), which may lower the cost of healthcare delivery. Examines skills needed for future advanced practice respiratory therapist (APRT) roles.

**RPT 7402. Adult Critical Care. (4 Hours)**

Offers students an opportunity to gain the foundations necessary to build a strong understanding of how to manage airways, administer specialty gases, manage mechanical ventilation, and deliver pharmacologic agents. Topics include assessment of patient status and changes in status and anticipating care based on laboratory results and reports on imaging. Offers students an opportunity to build a strong understanding of the effects of pharmacologic agents, how to anticipate care needed based on nutritional status, how to prevent ventilator-associated pneumonia, recognize and manage patients with infections and sepsis, manage end-of-life care, and prepare for disasters.

**Russian (RSSN)****RSSN 1101. Elementary Russian 1. (4 Hours)**

Explores the essentials of grammar, practice in pronunciation, acquisition of basic vocabulary, and idiomatic expressions of everyday Russian.

**RSSN 1102. Elementary Russian 2. (4 Hours)**

Continues RSSN 1101. Studies grammar and spoken and written forms of the language. Covers more advanced features of the language.

**Prerequisite(s):** RSSN 1101 with a minimum grade of C- or RSSN 1301 with a minimum grade of C-

**RSSN 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**RSSN 2101. Intermediate Russian 1. (4 Hours)**

Emphasizes further vocabulary building. Offers students an opportunity to master the fine points of grammar through written composition, prepared oral reports, and reading and discussion from contemporary Russian materials.

**Prerequisite(s):** RSSN 1102 with a minimum grade of C- or RSSN 1302 with a minimum grade of C-

**RSSN 2102. Intermediate Russian 2. (4 Hours)**

Builds on RSSN 2101 and focuses on further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through written composition, prepared oral reports, and reading and discussion from contemporary Russian materials.

**Prerequisite(s):** (RSSN 2101 with a minimum grade of C- or RSSN 2301 with a minimum grade of C- )

1010      Sales Management - CPS (SMT)

**RSSN 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**RSSN 3101. Advanced Russian 1. (4 Hours)**

Builds on RSSN 2102. Continues further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through advanced reading, composition, grammar review, and listening skills. Whenever possible, offers students an opportunity to engage in local community activities to enhance communication skills and cultural knowledge.

**Prerequisite(s):** RSSN 2102 with a minimum grade of C- or RSSN 2302 with a minimum grade of C-

**RSSN 3102. Advanced Russian 2. (4 Hours)**

Builds on RSSN 3101 and continues further development of vocabulary. Offers students an opportunity to continue to master grammar and conversation through advanced reading, composition, grammar review, and listening skills. Whenever possible, offers students an opportunity to engage in local community activities to enhance communication skills and cultural knowledge.

**Prerequisite(s):** RSSN 3101 with a minimum grade of C- or RSSN 3301 with a minimum grade of C-

**RSSN 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**RSSN 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**RSSN 4992. Directed Study. (1-4 Hours)**

Offers students a way of going beyond work given in the regular curriculum; may also enable students to complete major or minor requirements in certain situations. Priority is given to language majors and to juniors and seniors. May be repeated without limit.

**RSSN 5976. Directed Study. (1 Hour)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**Sales Management - CPS (SMT)**

**SMT 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SMT 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SMT 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SMT 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SMT 6010. Building Business Acumen. (3 Hours)**

Offers students an opportunity to develop business acumen by examining how a business achieves its goals, studying how to assess the critical interdependences across functions and divisions, and analyzing how financial and strategic decisions impact value creation. Emphasizes the short- and long-term trade-offs of business decisions; the role of marketing, sales, and customer service; and the tools to analyze and synthesize market and competitive data. Focuses on the assessment of key performance indicators that are most useful to appreciate the value of each customer to the organization.

**SMT 6020. Managing the Customer Experience. (3 Hours)**

Offers students a framework for managing the customer experience in the digital era. Examines ways to influence every stage of the customer-decision journey, from lead generation to building long-term customer relationships. Engages students in the application of best practices in sales and service management in both the business-to-consumer (B2C) and business-to-business (B2B) sectors. Emphasizes ethical standards and trust in the customer engagement process.

**SMT 6060. Decision Support and Sales Analytics. (3 Hours)**

Introduces current and emerging business analytical concepts and information technologies to support decision making and business intelligence for the sales industry. Discusses commercial decision support systems in various application areas using case studies, including CRM (customer relationship management), web analytics applications, sales force management systems, etc.

**SMT 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SMT 6980. Sales Management Capstone. (3 Hours)**

Offers students, working as individuals or in groups, an opportunity to design and carry out an interdisciplinary project conducted with real-world clients. Applies strategic frameworks and best practices to help organizations shift from seller-centric models to buyer-centric sales approaches.

**SMT 6983. Topics. (3 Hours)**

Covers special topics relevant to the sales management industry. May be repeated up to four times.

**School of the Museum of Fine Arts (SMFA)****SMFA 3000. Museum of Fine Arts Studio. (2-12 Hours)**

Offers course work at the School of the Museum of Fine Arts. May be repeated without limit.

**SMFA 4000. Museum of Fine Arts Capstone. (2-12 Hours)**

Offers capstone course work at the School of the Museum of Fine Arts. May be repeated without limit.

**Attribute(s):** NUpath Capstone Experience

**SMFA 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Sociology (SOCL)****SOCL 1000. Sociology at Northeastern. (1 Hour)**

Intended for first-year students in the College of Social Sciences and Humanities. Introduces students to liberal arts; familiarizes them with their major; develops the academic skills necessary to succeed (analytical ability and critical thinking); provides grounding in the culture and values of the University community; and helps to develop interpersonal skills—in short, familiarizes students with all skills needed to become a successful university student.

**SOCL 1101. Introduction to Sociology. (4 Hours)**

Explores diverse social phenomena, from how people try to look their best in face-to-face interactions; to how race, gender, and class shape identities and social conditions; to how industrial capitalism came to dominate the world. Offers students an opportunity to gain a grasp of key sociological theories and empirical research on topics such as social order, social conflict, and social change, as well as learn to identify social forces that shape human behavior, explain how these forces affect individuals and social groups, and make valid predictions about how they may shape future behavior or events.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**SOCL 1102. Sex, Gender, and Popular Culture. (4 Hours)**

Examines how femininities, masculinities, and different forms of sexual identity are produced and represented within popular culture. Using theories and concepts from both feminist/sexuality studies and popular culture studies, analyzes popular texts and media for their treatment of gender and sexuality and the intersection of those categories with racial and class identities. Explores the visual representation of women (and men) and analyzes how visual and textual media shape our attitudes and identities. Required reading and assignments include close readings of texts, film screenings, class discussions and activities, writing assignments, and creative projects.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**SOCL 1235. Social Psychology. (4 Hours)**

Studies the relationship between society and the individual. Focuses on three theoretical perspectives—symbolic interactionism, social structure and personality, and group processes—in order to understand how human behavior is tied to social and cultural contexts and how individuals shape and are shaped by group interaction. Topics may include socialization and how people develop a “social sense of self”; cross-cultural differences in interactional styles; pressures to conform to roles and stereotypes; deviance and mental health; inequality based on race/ethnicity, social class, and gender; identity formation and change, attitudes, and behavior, including prejudice and discrimination; and collective behavior, including social movements.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**SOCL 1245. Sociology of Poverty. (4 Hours)**

Analyzes American poverty in historical perspective, drawing on comparisons with other countries. Critically evaluates sociological research and theories relating to poverty. Considers causes and effects of poverty as well as societal responses to poverty and its consequences. Suitable for students in applied fields, such as nursing, criminal justice, education, allied health, premed, and prelaw.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**SOCL 1246. Environment and Society. (4 Hours)**

Examines the social, political, and economic forces behind the global environmental crisis. Topics include such issues as global warming and climate disruption, world resource availability and the global economic crisis, environmental justice and social inequities in the exposure to ecological hazards, science and technology, environmental degradation in the Third World, globalization and unfair trade, state power and the role of the polluter-industrial complex in the United States, the history of the environmental movement, and exemplary environmental policies and programs. This theoretically oriented course also involves practical experience in environmental problem solving.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**SOCL 1255. Sociology of the Family. (4 Hours)**

Provides a comparative approach to the study of families as social institutions, with particular emphasis on the changing patterns of family life. Introduces questions such as what families need and how the family is affected by other social institutions, political and economic forces, or cultural concerns. Considers how inequality (broadly defined) affects contemporary families. Substantive topics may include dating and marriage, cohabitation, health, and housing. Critically evaluates the methods that sociologists use to study changing practices of cohabitation, marriage, and divorce; interracial relationships; and changes in household composition, including same-sex or gender-nonconforming households.

**Attribute(s):** NUpath Societies/Institutions

**SOCL 1260. Sociology of Gender. (4 Hours)**

Considers why and how gender is socially constructed in U.S. society and looks at different theories of gender. Explores gender as an institution as well as different (cultural) expressions of masculinities and femininities. Includes topics of gender in everyday life as well as gender as an organizing principle in the institutions of families, education, workplaces, sexualities, religion, the media, politics, and forms of gender violence. SOCL 1260 and WMNS 1260 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**SOCL 1280. The Twenty-First-Century Workplace. (4 Hours)**

Analyzes the transformation of work since the advent of industrial capitalism. Emphasizes the organization and experience of work since World War II and the contemporary shifts underway in the wake of deindustrialization, the rise of service work, the emergence of the internet, the platform revolution, and the globalization of business organizations. Topics include the shifting nature of authority relations at work; changing forms of labor control; types of workplace culture in traditional and high-tech settings; and efforts to identify and reduce bias against women, minorities, and members of the LGBTQ community. Addresses dilemmas arising from the introduction of advanced technologies.

**Attribute(s):** NUpath Societies/Institutions

**SOCL 1295. Drugs and Society. (4 Hours)**

Focuses on historical and contemporary drug issues through the lens of classic sociological concerns. Rather than looking at only the legal-illegal discourse or historical/contemporary production, distribution, and use of drugs, the course frames drug topics around issues of class, race and ethnicity, age, and gender, asking the question of which drugs are used by whom and why at certain life stages. Specific topics include the high incarceration rates for nonviolent drug offenders; the role of drugs in death and dying via death penalty drugs and/or hospice care; mental health and drug treatment; and the potential perfidy of global drug testing and management.

**Attribute(s):** NUpath Societies/Institutions

**SOCL 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SOCL 2225. Sociology of Disability. (4 Hours)**

Examines how the social model of disability has challenged the predominant medical model defining disability as simply biological impairment and abnormality. Explores how the sociological perspective contributes to understanding lived experiences of disability and how disabilities are deeply interlinked to experiences of racial-ethnic, gender, and class inequality. According to the World Health Organization, some 15 percent of the world's population lives with disability. Yet what exactly is a disability? Offers students an opportunity to become conversant with theories of the social-historical construction of disabilities, the differences between visible and invisible impairments, the contributions of disability rights activism, and the bioethical questions about difference raised by medical technologies.

**Attribute(s):** NUpath Difference/Diversity, NUpath Ethical Reasoning

**SOCL 2270. Race, Ethnicity, and Inequality. (4 Hours)**

Focuses on the social construction of race and ethnicity and the nature of dominant/minority relations in the United States. Emphasizes the peculiar evolution of race relations in U.S. history, the political and economic conditions that have transformed race relations, and the nature of contemporary racial and ethnic relations in the United States. Topics include immigration, ethnic and racial identity, discrimination, and race-based policies (e.g., residential restrictive codes, Jim Crow segregation). Offers students an opportunity to develop a critical lens from which to observe and interpret contemporary debates over structural racism.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**SOCL 2280. Sociology of Mental Health. (4 Hours)**

Explores how mental health and illness are socially constructed. Compares perspectives to illustrate how population mental health is shaped by social, political, and economic conditions. Substantive topics may include the medicalization of deviant behavior, changing definitions of mental illness across time and cultures, the social determinants of mental illness, and the responses by the mental health care system.

**SOCL 2303. Gender and Reproductive Justice. (4 Hours)**

Introduces the social, legal, and economic barriers to accessing reproductive healthcare domestically and internationally. Draws on various theoretical and analytic tools including critical race theory, critical legal theory, sociology of science, human rights, feminist theory, and a range of public health methods. Access to reproductive health services, including abortion, is one of the most contested political, social, cultural, and religious issues today. Covers domestic, regional, and international legal and regulatory frameworks on sexual reproductive health. HIST 2303, SOCL 2303, and WMNS 2303 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**SOCL 2320. Statistical Analysis in Sociology. (4 Hours)**

Offers students an opportunity to obtain knowledge and skills essential for understanding the theory and practice of social statistics commonly used in social research. Topics covered include the operationalization of abstract concepts; descriptive statistics; correlation; bivariate regression; central limit theorem; confidence intervals; hypothesis testing; and key concepts such as association, causation, and spurious relationships. Statistical software is used to complete assignments.

**Prerequisite(s):** SOCL 1101 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**SOCL 2321. Research Methods in Sociology. (4 Hours)**

Introduces students to the range of research methods used by sociologists. Covers experimental research, field research, survey research, and historical-comparative research. Sampling, the rules of evidence in empirical research, research ethics, and the place of values are discussed.

**Prerequisite(s):** SOCL 1101 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**SOCL 2323. Ethnographic Methods. (4 Hours)**

Focuses on the practical, ethical, and theoretical issues underlying qualitative field research. Emphasizes firsthand experience with participation, observation, interviewing, note-taking, data analysis, and ethnographic writing.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or SOCL 1101 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data, NUpath Integration Experience

**SOCL 2355. Race, Identity, Social Change, and Empowerment. (4 Hours)**

Introduces and sensitizes students to the forms, practices, and effects of racism and discrimination on the various populations in the United States and presents frameworks for understanding and working with people with histories of discrimination and different cultural identities. Pays special attention to human services with diverse populations in schools, prisons, and employment assistance programs.

**Prerequisite(s):** ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity

**SOCL 2357. Growth and Decline of Cities and Suburbs. (4 Hours)**

Introduces students to the field of urban studies. Focuses on these central issues: how cities and suburbs evolve, what makes a city or suburb a good place to live, and how cities and suburbs are (or are not) planned. Students review the ways in which urban scholars and practitioners study cities and suburbs, their research methodologies, definition of issues, and division of labor among different disciplines. Students explore the roles of individuals, communities, the private sector, and government in planning and shaping the city.

**SOCL 2358. Current Issues in Cities and Suburbs. (4 Hours)**

Introduces students to pressing urban issues: urban sprawl, poverty, education, transportation, economic development, and housing, through an intensive analysis of the Boston metropolitan area. The course is cotaught by university faculty and practitioners in government, community, and nonprofit organizations throughout the metropolitan area. Offers students the opportunity to analyze Boston data, go on outings to see development in progress, talk with urban practitioners about what they do, and conduct research on an urban issue of their choice.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**SOCL 2359. Current Issues in Cities and Suburbs Abroad. (4 Hours)**

Introduces students to pressing urban issues—urban sprawl, poverty, education, transportation, economic development, and housing—through an intensive analysis of the metropolitan area. Taught by university faculty and local practitioners in government, community, and nonprofit organizations. Offers students an opportunity to analyze urban data, to go on outings to see development in progress, and to talk with urban practitioners about what they do in urban contexts outside of the United States. To be taken as part of a Dialogue of Civilizations. May be repeated without limit.

**Attribute(s):** NUpath Difference/Diversity, NUpath Integration Experience, NUpath Societies/Institutions

**SOCL 2365. Latinx Youthhood in the United States. (4 Hours)**

Surveys topics related to Latinx youthhood. Includes historical, social, and cultural roots of Latinx youthhoods in the United States and how Latinx youthhood has been shaped within colonial, transnational, and global contexts. Emphasizes understanding the ways in which social institutions found in and across the United States and Latin American sending communities have structured Latinx youthhoods in relation to race, gender, class, and citizenship, as well as how Latinx youths have exercised agency to contest the social inequalities resulting from the practices and policies of these social institutions.

**Attribute(s):** NUpath Societies/Institutions

**SOCL 2485. Environment, Technology, and Society. (4 Hours)**

Focuses on the connections between the development of modern nation-states and the control of nature. Explores the role human societies play in such events as climate change, tsunamis, and droughts. Asks how industrialization and the process of science and technology development are related to our transforming environmental conditions, as well as how the social sciences, the sciences, and engineering are transforming to address these issues. Draws on social theory, environmental history, anthropology/sociology, art/design, and open-source technologies to investigate theoretically and methodologically the sources, experiences of, and solutions for environmental health questions.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D- or SOCL 1246 with a minimum grade of D- or WMNS 1103 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**SOCL 2500. Race and Global Human Mobility. (4 Hours)**

Examines the relationship between race and the movement of people around the globe. Offers students an opportunity to acquire a concrete understanding of how race and ethnicity (as social constructions) have developed as people have migrated (under free will or forced circumstances) within and across geopolitical territories (e.g., colonies, countries) in the past (1400s) and through the present. Ethnoracial-related conflicts connected to migration (e.g., rebellions by the enslaved during the Atlantic slave trade, Rwandan genocide, Syrian civil war) may also be explored.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**SOCL 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SOCL 2991. Research Practicum. (2-4 Hours)**

Involves students in collaborative research under the supervision of a faculty member. Offers students an opportunity to learn basic research methods in the discipline. Requires permission of instructor. May be repeated once for up to 4 total credits.

**SOCL 3200. Cities in Global Context. (4 Hours)**

Examines the roots of the urbanization process, major ways of thinking about it, and the development of world cities and megacities. The twenty-first century will be a century in which urbanism is a central problem and opportunity. Considers the economic, political, cultural, and environmental dimensions of urbanism across the globe. Includes specific case studies from around the world. Encourages students to develop a knowledge of particular cities in order to examine the key themes of the course. INTL 3200, ANTH 3200, and SOCL 3200 are cross-listed.

**SOCL 3241. Violence and Society. (4 Hours)**

Examines the notion of violence and its pervasive presence in the social institutions we create and maintain every day. Addresses key debates and findings in sociological literature on violence, drawing on other disciplines as they prove helpful. Sociology tells us that the beliefs, values, and norms that characterize the United States legitimize the preference for violence, largely through the obvious venues of the mass media that glorify violence but also in the subtler structural arrangements collectively constructed and maintained in our everyday behaviors. Offers students an opportunity to understand how the structure of our society and its social institutions inhibit or facilitate violent behavior.

**Attribute(s):** NUpath Societies/Institutions

**SOCL 3300. Social Theory. (4 Hours)**

Reviews the dominant theoretical traditions in classical and contemporary sociology, showing the links between the social thought of the eighteenth and nineteenth centuries and current social thought.

**Prerequisite(s):** SOCL 1101 with a minimum grade of D- ; (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**SOCL 3407. The Immigrant Experience: Ethnicity, Race, and Inequality in America. (4 Hours)**

Presents the sociological study of immigration in the United States. Emphasizes the ways U.S. institutions (e.g., federal, state, and local governments; the legal system; the economy; schools; families) have shaped immigrant integration and incorporation and vice versa. Presents theories and concepts that explain how experiences of integration and incorporation differ for disparate groups of immigrants and their children due to their associated social categories including race, class, gender, sexuality, and citizenship. Examines how local and state institutions (Boston and Massachusetts, respectively) have shaped immigrant integration in recent years.

**Prerequisite(s):** SOCL 1101 with a minimum grade of D- or ANTH 1101 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**SOCL 3441. Sociology of Health and Illness. (4 Hours)**

Offers a substantial overview of the sociology of health and illness. Medical sociology is an important subfield of sociology with important links to public health, social psychology, psychology, and other medical fields. Emphasizes several critical areas: society and disease; theoretical understandings of health inequalities; medicalization and social control; healthcare professions and professionalization; and the American healthcare system. Offers students an opportunity to obtain analytical frameworks to explore other topics in medical sociology not covered in this course.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions, NUpath Writing Intensive

**SOCL 3450. Class, Power, and Social Change. (4 Hours)**

Explores theories and research on the institutionalized forms of inequality that have accompanied the rise of advanced capitalism in Western society. Major topics include the competing definitions of class that have developed among social scientists; the relation between class and race in the United States; how class and gender have intersected historically; and the link between workers' movements, political systems, and the forms that capitalist development has assumed in Western Europe and the United States. Students conduct projects in which they explore the conceptions of social justice held by members of subordinate groups.

**Attribute(s):** NUpath Societies/Institutions

**SOCL 3468. Social Movements. (4 Hours)**

Introduces the social, cultural, and political dynamics that surround social movements, both historically and in the contemporary world. Emphasizes theory and research on national and transnational social movements, including studies of revolutions and political upheavals, racial justice and demands for civil and human rights, movements for gender equality, and other instances of movements for social and political change. Focuses on how structural factors shape social movement emergence and development and how social movements in turn shape the structure of societies.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**SOCL 3487. Applied Sociology: Practice and Theory. (4 Hours)**

Offers the academic component of the experiential education requirement for sociology majors; to be taken after students have completed the experiential component. Provides a seminar format in which students will reflect upon their approved experience (that is, co-op, internship, community service, and so on) and integrate it into a research project. Students who have completed study abroad or a service-learning course in the department may not have to take this course.

**Prerequisite(s):** SOCL 1101 with a minimum grade of D- or ANTH 1101 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**SOCL 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SOCL 4485. Sociology of Education. (4 Hours)**

Examines the ways in which schools and societies are interconnected. More specifically, introduces the educational practices and policies that reproduce or challenge social stratification, social mobility, and adult socio-economic success. Explores the relationships among social actors including teachers, students, and parents, as well as educational policies and practices that shape educational equity and opportunity. Focuses on curriculum development and implementation, ability grouping and tracking, teacher preparation and professional development. Explores how these and other educational policies and practices may differ due to race, class, gender, and citizenship.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D-

**Attribute(s):** NUpath Societies/Institutions

**SOCL 4520. Race, Class, and Gender. (4 Hours)**

Considers the intersection of race, class, and gender in social structure, institutions, and people's lives. Utilizes an interdisciplinary approach to focus on the socially constructed nature of these concepts and how they shape and create meaning in individual lives. Difference with an emphasis on inequality and varying life chances is central for understanding our society and is central to our work. Requires a significant amount of reading. Class format is like a seminar; students are expected to participate, take responsibility, and write a paper. SOCL 4520 and WMNS 4520 are cross-listed.

**Prerequisite(s):** (SOCL 1101 with a minimum grade of D- or ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- ); (ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C ) or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Writing Intensive

**SOCL 4522. Environmental Justice. (4 Hours)**

Offers students an opportunity to engage in advanced social science research on topics relating to environmental justice, citizen science, and environmental health. Examines various environmental justice topics with the goal of producing a research project or paper. Case studies examined include the impacts of toxic waste dumping on human health and the environment, the role of global climate change in creating new waves of migration around the world, the rise of the Slow Food movement, and the relationship between environmental and data justice. Studies how to redesign research methods, tools, and processes to support environmental justice.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or HUSV 2400 with a minimum grade of D- or (HUSV 2401 with a minimum grade of D- or ENVR 2401 with a minimum grade of D- ) or INTL 1101 with a minimum grade of D- or PHIL 1180 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D- or SOCL 1246 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- ; (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Societies/Institutions, NUpath Writing Intensive

**SOCL 4526. Afro-Asian Relations in the Americas. (4 Hours)**

Examines the comparative racialization of Blacks and Asians in the Americas and relations between these communities. Introduces sociological theories of race/ethnicity, a chronology of Afro-Asian relations in the United States, and the impact of 1970s deindustrialization and post-1965 Asian immigration. Covers the internationalism of Black and Asian leaders (e.g., W.E.B. du Bois and Mao Tse-Tung) in the developing nations and the overlapping Civil Rights, Black Power, and Asian American movements.

**Prerequisite(s):** SOCL 1101 with a minimum grade of D- or ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**SOCL 4528. Technology and Society. (4 Hours)**

Focuses on the social and political context of technological change and development. Through readings, course assignments, and class discussions, offers students an opportunity to learn to analyze the ways that the internet, artificial intelligence, and other technological advances have required a reworking of every human institution—both to facilitate the development of these technologies and in response to their adoption.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**SOCL 4600. Senior Seminar. (4 Hours)**

Offers students an opportunity to integrate and apply knowledge of the discipline by building on completed course work and conducting original research on a topic of their choice. Requires students to produce a research paper due at the end of the semester. This seminar operates as an intellectual workshop in which students share the process, as well as the results, of their research with the group. The class comes together to inform, guide, critique, and support one another's research efforts in a collaborative fashion. Students are expected to make constructive comments on the work of others and to freely exchange ideas.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**SOCL 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**SOCL 4971. Junior/Senior Honors Project 2. (4 Hours)**

Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated once.

**Prerequisite(s):** SOCL 4970 with a minimum grade of D-

**Attribute(s):** NUpath Capstone Experience

**SOCL 4973. Special Topics in Sociology. (4 Hours)**

Designed as a specialized themes course for students with experience in sociology and/or anthropology. Takes advantage of unique opportunities—visiting guests, special thematic interests—which are not part of the regular curriculum. May be repeated up to three times.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or SOCL 1101 with a minimum grade of D- or WMNS 1103 with a minimum grade of D-

**SOCL 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SOCL 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated once.

**Attribute(s):** NUpath Integration Experience

**SOCL 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**SOCL 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**SOCL 5240. Feminist Resistance. (4 Hours)**

Engages students in the study of a variety of forms of feminist resistance in recent history, emphasizing the United States in the context of cross-cultural examples. Examines key feminist texts and manifestos and studies feminist activism in coalition with other social movements. Students identify and analyze unique features of gender-based activism in itself and in its intersections with other social movements, including movements and activism focused on race, class, sexuality, and physical ability.

**Attribute(s):** NUpath Societies/Institutions

**SOCL 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SOCL 7001. Proseminar 1: Acclimating to Graduate School. (1 Hour)**

Helps first-year students develop a firm understanding of the PhD Sociology program requirements and helps them develop beneficial skills and strategies to complete those requirements in a timely manner. Focus on relevant topics such as articulating learning expectations from the graduate program; developing individual timelines and time management strategies to meet those expectations; identifying resources on campus and beyond that are needed to meet learning expectations; and developing concrete goals for acquiring appropriate writing, reading skills, and research areas expertise in the PhD program.

**SOCL 7002. Proseminar 2: Academic Planning. (1 Hour)**

Helps first-year students further develop beneficial skills and strategies to complete program requirements by building on the first semester proseminar. Focuses on relevant topics such as networking, building, and developing a team of mentors and peer supports; writing and talking about research; getting research funded; and learning wellness strategies for surviving graduate school.

**SOCL 7003. Proseminar 3: Committee, Topics, and Reading Lists. (1 Hour)**

Helps students develop beneficial skills and strategies to complete program requirements and become more professionalized as sociologists. This third proseminar provides the structure and peer feedback designed to help students build and work through their first field statement reading list. Students produce an annotated bibliography. The weekly exercises are designed to help students create the reading list in collaboration with faculty mentors and other experts in the field.

**SOCL 7004. Proseminar 4: Field Statement Writing. (1 Hour)**

Offers students an opportunity to develop beneficial skills and strategies to complete program requirements and to become more professionalized as sociologists. Students share field statement drafts, participate in peer evaluations, and practice giving constructive criticism on others' work and address others' critical feedback. Students draft a field statement or publishable paper.

**SOCL 7100. Queer Theory: Sexualities, Genders, Politics. (4 Hours)**

Introduces the core texts and key debates that have shaped queer theory and examines the intersections between queer theory and feminism and critical race theory. Seeks to provide an understanding of expansive and radical contemporary queer politics by analyzing foundational queer and feminist texts, pushing beyond narrow constructions of identity politics, anti-discrimination policy, and rights-based reforms. Engages queer theory by means of a rich philosophical and political interrogation of the meaning and content of "queer." SOCL 7100 and WMNS 7100 are cross-listed.

**SOCL 7200. Foundations of Social Theory 1. (4 Hours)**

Studies the classic theorists including Durkheim, Weber, Marx, and others.

**SOCL 7201. Foundations of Social Theory 2. (4 Hours)**

Reviews the dominant theoretical traditions in contemporary sociology, examining the key assumptions, terminology, weaknesses, and strengths of the pluralist, managerialist, neo-Marxist, feminist, and postmodern paradigms. Strives not only to expose students to the giants in the field but, more important, to give students the intellectual tools to situate entire theoretical traditions vis-à-vis one another. Introduces students to various schools of thought. Offers students the opportunity to learn "how to think" sociologically and theoretically—that is, to go beyond simplistic and descriptive accounts of social phenomena to offer more systematic and insightful explanations.

**SOCL 7221. Globalization, Development, and Social Justice. (4 Hours)**

Explores the rise of neoliberal globalization and its impact on local and national communities around the world. Examines complex patterns of resistance, including place-based struggles and transnational social movements. Combines theoretical analysis of global capitalism, development, the politics of resistance, and reformist/radical alternatives with the study of concrete struggles in defense of land, labor and human rights, indigenous cultures and identities, and ecological sustainability.

**SOCL 7222. Gender and Globalization. (4 Hours)**

Explores current issues and debates relating to the gendered effects of globalization and neoliberal reforms and the entanglement of their economic, social, and cultural effects. Gender research on globalization has expanded notions of work and migration to include the politics of location as well as the feminization of labor in transnational production. This seminar focuses on new forms of subjectivities, ideologies, sovereignty, and notions of citizenship in postindustrial and postcolonial settings. Topics may include, but are not limited to, poststructuralist feminist critiques, financial markets, migration, care and factory work, as well as the privatization of urban space.

**SOCL 7226. Economy, Politics, and Social Change. (4 Hours)**

Offers a broad survey of scholarly debates on the redistribution of political power, economic power, and social capital across the globe. Emphasizes an ethnographic analysis of how colonial and imperial legacies inform contemporary arrangements that structure inequality and how political imaginations are exercised through aesthetics, identities, and institutions. Considers how experiments with economic justice and juridical and political forms of justice find expression in contemporary grassroots movements and theories. Draws on interdisciplinary conversations from the social sciences and humanities to examine and compare radical forms of social change across various global contexts.

**SOCL 7227. Race and Ethnic Relations. (4 Hours)**

Offers a graduate-level seminar in the sociology of race and ethnic relations. Explores the key social, economic, political, and ideological forces shaping race and ethnic relations in the United States, past and present, and the main theoretical, methodological, and substantive debates in the "race and ethnicity" subfield of sociology. Course topics include, but are not limited to, the conceptual and intellectual foundations of the study of race and ethnic relations; the sources and consequences of ethnic and racial identities; urban poverty and dynamics of racial residential segregation; the role of wealth in creating and perpetuating racial inequality; the "new black middle class"; and contemporary debates regarding racial prejudice, discrimination, and redistributive public policies in the United States.

**SOCL 7229. International Migration. (4 Hours)**

Offers an in-depth critical sociological inquiry into international migration across the world. Addresses the disconnect and tension between the international agreements (principles of international law and legal definitions) and actual experiences and everyday practices of human mobility across borders on the ground. By critically examining how irregular migration has been racialized, securitized, and criminalized in the age of the war on terror, this seminar engages an intersectional analysis of race, ethnicity, religion, gender, and class. Uses ethnographies, case studies, documentaries, and comparative analysis to analyze a wide range of issues from integration, inclusion/exclusion, and racialization of migrants to promigrant movements and native-migrant solidarity.

**SOCL 7231. Sociology of Prejudice and Violence. (4 Hours)**

Examines the roots and consequences of violent behavior in society and the individual. Topics vary from semester to semester, but will include serial murder, massacres, hate crimes, workplace murder, group violence including cults, and mass media portrayals of violence.

**SOCL 7243. Sociology of Health and Illness. (4 Hours)**

Studies social aspects of illness and medicine, historically and cross-culturally. Focuses on illness and the medical profession in modern society and their structural settings: the community, the hospital, the medical school. Critically examines research studies in the field and specifies problems for future research.

**SOCL 7263. Social Psychology of Stratification. (4 Hours)**

Explores the social psychological dimensions of structured social inequality. Overviews the "social psychologies" embedded in the classical social theorists, then explores the literature on sociological social psychology (as opposed to its psychological cousin), identifying key theoretical frameworks and focusing on "social structure and personality" (or "social structure and attitudes") research. Explores relevant literatures on various "subjective" responses to stratification including the self-concept, stratum (that is, race, class, or gender) identification and consciousness, the process of legitimization, stratification beliefs (or stratification ideology), racial attitudes, and links between these phenomena and various policy attitudes and preferences (support for affirmative action, wealth redistribution, and so on). Also explores the ways in which such responses may contribute to the maintenance and reproduction of the status quo (social reproduction), and social change.

**SOCL 7267. Environment, Health, and Society. (4 Hours)**

Studies contested illnesses, which are diseases or conditions in which there is dispute over environmental causation. For many diseases and conditions attributed to environmental and occupational exposure, the disease or condition and/or its causes are discovered by laypeople in workplaces and communities, with considerable attention to chemical exposures. This seminar synthesizes a diverse set of fields, encompassing environmental sociology, medical sociology, medical anthropology, science studies, history of medicine, history of science, environmental health, community-based participatory research, environmental justice, and environmental public health. Emphasizes both political economic and ideological factors as determinants of contestation. Also examines issues of interdisciplinary collaboration between social scientists and environmental health scientists.

**SOCL 7287. Social Movements in Health. (4 Hours)**

Offers a graduate seminar centering on health social movements. Also explores general social movement theory and research. Uses concepts from science and technology studies, and covers some core medical sociology concerns such as health inequalities; personal experience of illness; and lay-professional disputes over disease identification, causation, prevention, and treatment. Among the movements covered are disability rights, breast cancer activism, medical activism, Black health movements, environmental justice, community health centers, patients' rights, and health access movements.

**SOCL 7962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SOCL 7976. Directed Study. (1-4 Hours)**

Comprises reading and research directed by a faculty member. May be repeated without limit.

**SOCL 7990. Thesis. (1-4 Hours)**

Offers thesis supervision by members of the department. May be repeated without limit.

**SOCL 8960. Exam Preparation—Doctoral. (0 Hours)**

Taken while completing one of two PhD field statements under faculty supervision. May be repeated three times.

**SOCL 8984. Research. (1-4 Hours)**

Offers an opportunity to conduct research under faculty supervision. May be repeated without limit.

**SOCL 8986. Research. (0 Hours)**

Offers the student the opportunity to conduct full-time research. May be repeated without limit.

**SOCL 9000. PhD Candidacy Achieved. (0 Hours)**

Indicates successful completion of the doctoral comprehensive exam.

**SOCL 9986. Research. (0 Hours)**

Offers the student the opportunity to conduct full-time research. May be repeated without limit.

**SOCL 9990. Dissertation Term 1. (0 Hours)**

Offers theoretical and experimental work conducted under the supervision of a departmental faculty.

**Prerequisite(s):** SOCL 9000 with a minimum grade of S

**SOCL 9991. Dissertation Term 2. (0 Hours)**

Offers dissertation supervision by members of the department.

**Prerequisite(s):** SOCL 9990 with a minimum grade of S

**SOCL 9996. Dissertation Continuation. (0 Hours)**

Offers continued thesis work conducted under the supervision of a departmental faculty.

**Prerequisite(s):** SOCL 9991 with a minimum grade of S or Dissertation Check with a score of REQ

## Sociology - CPS (SOC)

**SOC 1100. Introduction to Sociology. (3 Hours)**

Examines the basic theoretical perspectives, research methods, and concepts of sociology, including society, culture, institutions, status and role, socialization, social groups, and the role of the individual within society. Considers a number of specific topics to help explore these concepts, including crime, deviance, sexualities, gender, education, and the environment.

**Attribute(s):** NUpath Societies/Institutions

**SOC 1210. Sociology of Boston. (3 Hours)**

Examines Boston from the perspective of environmental development, neighborhood and intergroup relations, institutional services, and symbolic meanings. The city is a laboratory for exploring the people's search for a lifestyle and the satisfaction of their needs. Offers students an opportunity to learn about urban sociology by using Boston as the case study. Examines the social history and historical development of contemporary Boston and analyzes selected current sociological issues.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**SOC 1220. Engaging Difference and Diversity. (3 Hours)**

Introduces the issue of diversity in the United States and across the globe. All humans share the same basic capacity for thinking, feeling, and social and moral reasoning. This general capacity takes specific cultural shape as each group adapts to different environments and historical situations and over time constructs a cultural tradition. Offers students an opportunity to articulate this knowledge intellectually and to apply it to everyday living and practices.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**SOC 1230. Race and Ethnicity. (3 Hours)**

Examines race and ethnicity as constructed differences. Explores the reasons for their existence, the power dynamics behind constructions of difference, the impact of difference on identity, and ways that visual and other presentations influence perceptions of self and others. Because human beings belong to different racial and ethnic groups, the study of these constructs is important to sociology. Explores the history of race and ethnicity and how history has influenced the study of these topics.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**SOC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SOC 2100. Popular Culture. (3 Hours)**

Explores the significance of expressions of popular culture such as film, television, music, and literature. Examines media production, organization, technology, and audience consumption. Discusses countercultures and subcultures, moral and ethical considerations, high and low culture, independent and corporate business influences, and consumerism and consumption. Topics include the effects of popular culture on race, gender, and class. Covers the relationship between popular culture and existing socioeconomic institutions.

**Attribute(s):** NUpath Interpreting Culture

**SOC 2200. Drugs and Society. (3 Hours)**

Introduces the sociology of drugs. Examines social definitions of licit and illicit drugs, conditions of their use, and socialization into drug use. Surveys deviant drug use and the effects of social control on definitions and use of drugs. Applies the relevant sociological theories of deviance and social control.

**SOC 2240. Death and Dying. (3 Hours)**

Examines the treatment of death and dying, including problems faced by health-care professionals, family members, institutions, the funeral industry, and the dying themselves. Covers cross-cultural perspectives, the social distribution of mortality, the changing nature of death, and the ethical problems in determining life and death. Emphasizes abortion, suicide, and ceasing medical intervention.

**SOC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SOC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SOC 4955. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**SOC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SOC 4991. Research. (1-4 Hours)**

Offers students an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**SOC 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**Sociology - CPS Specialty (SCLY)****SCLY 1210. Sociology of Boston. (4 Hours)**

Introduces students to American urban studies and urban theory, with a special focus on spatial expressions of intra-urban inequalities. Focuses on theories of formation of urban inequalities, social and immigrant segregation, segregation and integration, gentrification as a process and how it impacts displacement, and theories of formation of neighborhoods and the evolution of collective efficacy. The class tests theories discussed in class by exploring specific neighborhoods in Boston. Offers students an opportunity to learn about the Irish influence in Dorchester, the Italian influence on the West End, and the African-American influence in Roxbury. Concludes with a concentration on how globalization has fueled a new wave of immigrant communities to grow and evolve in the twenty-first century.

**Spanish (SPNS)****SPNS 1101. Elementary Spanish 1. (4 Hours)**

Begins the integrated development of elementary language skills through cultural exploration. Includes class discussion and project-based learning. Offers students an opportunity to gain a deeper understanding of daily life, social norms, and family structure in Spanish-speaking countries. Designed for students with little or no knowledge of Spanish.

**Prerequisite(s):** Placement in SPNS 1101 with a score of 1101

**SPNS 1102. Elementary Spanish 2. (4 Hours)**

Builds on SPNS 1101. Continues the integrated development of elementary language skills through cultural exploration. Includes class discussion and project-based learning. Offers students an opportunity to gain a deeper understanding of the linguistic, cultural, and geographic diversity of the Spanish-speaking world.

**Prerequisite(s):** SPNS 1101 with a minimum grade of C- or Placement in SPNS 1102 with a score of 1102

**SPNS 1240. Latin American Film. (4 Hours)**

Examines contemporary works of cinematography in Latin America, focusing on the culture and imagery of the Spanish-, French-, and Portuguese-speaking peoples of the Western hemisphere, including the United States. Critically engages—from a technical (cinematographic), genre, and sociohistorical perspective—topics of history, memory, and cultural resiliency; colonialism, racism, and patriarchy; dictatorship, revolution, and democratization; and nationalism, dependency, and globalization. Conducted in English; most films are in French, Portuguese, or Spanish with English subtitles.

**Attribute(s):** NUpath Interpreting Culture

**SPNS 1504. Cultural History of Spain. (4 Hours)**

Examines chronologically the forces that have forged Spanish culture and have made Spain the pluralistic society and multinational country it is today. Traces the development of the peoples of the Iberian Peninsula from prehistoric times to the present. Based primarily on the history of ideas, the arts, and architecture, incorporates history, sociology, anthropology, geography, economics, and politics. Conducted in English.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**SPNS 1505. Latin American Culture, History, and Politics. (4 Hours)**

Offers students an opportunity to learn about Latin American culture through the study of historical episodes such as colonization, independence, and dictatorships. Explores current issues including migration, globalization, and digital media. Examines writings by Latin American authors and selected films from Latin America. Conducted in English.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**SPNS 1973. Special Topics in Hispanic Culture. (4 Hours)**

Offers an in-depth exploration of a specific topic related to Hispanic culture, literature, and/or language. Taught in English. May be repeated twice.

**SPNS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SPNS 2101. Intermediate Spanish 1. (4 Hours)**

Builds on SPNS 1102 and begins the integrated development of intermediate language skills through cultural exploration. Includes class discussion and project-based learning. Offers students an opportunity to gain a deeper understanding of modern life in Spanish-speaking countries and efforts to preserve cultural heritage.

**Prerequisite(s):** SPNS 1102 with a minimum grade of C- or Placement in SPNS 2101 with a score of 2101

**SPNS 2102. Intermediate Spanish 2. (4 Hours)**

Builds on SPNS 2101 and continues the integrated development of intermediate language skills through cultural exploration. Includes class discussion, project-based learning, and one-on-one conversations with native speakers from around the Spanish-speaking world. Offers students an opportunity to prepare to travel, live, or work abroad and gain a deeper understanding of the social and political issues that have shaped daily life in Spanish-speaking countries.

**Prerequisite(s):** (SPNS 2101 with a minimum grade of C- or Placement in SPNS 2102 with a score of 2102)

**SPNS 2900. Specialized Instruction in Spanish. (1-4 Hours)**

Focuses on developing students' language proficiency and cultural competence within a specific context. May be repeated twice for a maximum of 12 semester hours, when topics vary.

**Prerequisite(s):** SPNS 1102 with a minimum grade of C-

**SPNS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SPNS 3101. Advanced Spanish 1. (4 Hours)**

Builds on SPNS 2102 and begins the integrated development of advanced language skills through cultural exploration. Includes class discussion, project-based learning, and one-on-one conversations with native speakers from around the Spanish-speaking world. Offers students an opportunity to gain a deeper understanding of the (de)construction of social, political, and interpersonal borders in the Spanish-speaking world.

**Prerequisite(s):** SPNS 2102 with a minimum grade of C- or Placement in SPNS 3101 with a score of 3101

**SPNS 3102. Advanced Spanish 2. (4 Hours)**

Builds on SPNS 3101 and continues the integrated development of advanced language skills through cultural exploration. Includes class discussion, project-based learning, and one-on-one conversations with native speakers from around the Spanish-speaking world. Offers students an opportunity to gain a deeper understanding of the diverse gender, ethnic, racial, religious, national, and linguistic identities of Hispanic and Latinx communities in Spanish-speaking countries and the United States.

**Prerequisite(s):** SPNS 3101 with a minimum grade of C- or Placement in SPNS 3102 with a score of 3102

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**SPNS 3240. Social Justice in Latin American and Latinx Film. (4 Hours)**

Examines issues in social justice in contemporary works of cinematography from Latin American and Latinx cultures. Critically engages—from a technical (cinematographic) and sociohistorical perspective—topics related to the representations of historically vulnerable populations, such as people of color, women, LGBTQIA+ persons, and indigenous peoples. Conducted in Spanish.

**Prerequisite(s):** SPNS 2102 with a minimum grade of C- or SPNS 3101 with a minimum grade of C- or SPNS 3102 with a minimum grade of C- or Placement in SPNS 3101 with a score of 3101 or Placement in SPNS 3102 with a score of 3102

**Attribute(s):** NUpath Interpreting Culture

**SPNS 3401. Spanish for Healthcare Professionals 1. (4 Hours)**

Designed to prepare students to interact with Spanish-speaking patients effectively and empathetically by exploring Hispanic cultural perspectives related to health and healthcare throughout the Spanish-speaking world, focusing on the Latino population in the United States. Offers students an opportunity to develop their linguistic skills tailored specifically to healthcare settings. Introduces a broad range of medical vocabulary and reviews the grammatical structures necessary to take a medical history, conduct a physical exam, discuss a diagnosis and treatment with patients, and perform other medical tasks in Spanish.

**Prerequisite(s):** SPNS 2102 with a minimum grade of C- or SPNS 3101 with a minimum grade of C- or SPNS 3102 with a minimum grade of C- or Placement in SPNS 3101 with a score of 3101 or Placement in SPNS 3102 with a score of 3102

**SPNS 3402. Spanish for Healthcare Professionals 2. (4 Hours)**

Builds on SPNS 3401. Continues to offer students an opportunity to prepare to interact effectively and empathetically with Spanish-speaking patients through the development of linguistic skills tailored to healthcare settings. Explores Hispanic cultural perspectives related to health and healthcare. Delves deeper into current topics in healthcare such as mental illness and its representation, gender-affirming care, reproductive care, and public health emergencies, among others.

**Prerequisite(s):** SPNS 3401 with a minimum grade of C-

**SPNS 3403. Spanish for Global Professionals. (4 Hours)**

Offers students an opportunity to learn how to communicate effectively with Spanish-speaking clients and colleagues in professional settings in the United States and abroad. Designed to develop students' formal language skills and intercultural competence. Explores a wide range of cultural perspectives such as workplace dynamics and diversity, the use of technology and social media, privacy and data protection, and personal finance, among others. Students build a portfolio website in Spanish that highlights their expertise in their own field.

**Prerequisite(s):** SPNS 2102 with a minimum grade of C- or Placement in SPNS 3101 with a score of 3101 or SPNS 3101 with a minimum grade of C- or Placement in SPNS 3102 with a score of 3102 or SPNS 3102 with a minimum grade of C-

**SPNS 3502. Authentic Spanish Grammar. (4 Hours)**

Explores the authentic use of advanced grammar, focusing on improving both speaking and writing skills. Presents advanced grammatical structures, analyzes their use in authentic cultural texts, and applies them to both spoken and written tasks. Offers students an opportunity to discuss cultural topics with peers and native speakers, as well as to develop an ePortfolio of written texts and engage in the peer-editing process.

**Prerequisite(s):** SPNS 3101 with a minimum grade of C- or SPNS 3102 with a minimum grade of C- or Placement in SPNS 3102 with a score of 3102; (ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**SPNS 3601. Exploring Spoken Spanish. (4 Hours)**

Uses project-based learning to help students build their confidence to interact with native speakers throughout the Spanish-speaking world by improving their pronunciation and listening comprehension, as well as increasing their awareness of the variation that exists in spoken Spanish. Briefly introduces the history of the Spanish language and the many Spanish-speaking communities around the world. Explores the Spanish sound system as it relates to both students' own pronunciation and to the diversity of dialects in the Spanish-speaking world. Offers students an opportunity to examine their own pronunciation, participate in one-on-one conversations with native speakers, analyze real examples of spoken Spanish, and consider the role of Spanish in bilingual communities around the world.

**Prerequisite(s):** SPNS 2102 with a minimum grade of C- or SPNS 3101 with a minimum grade of C- or SPNS 3102 with a minimum grade of C- or Placement in SPNS 3101 with a score of 3101 or Placement in SPNS 3102 with a score of 3102

**SPNS 3602. Introduction to Spanish Linguistics. (4 Hours)**

Introduces students to the study of language and the analysis of the Spanish language and its structure. Through project-based learning, students apply their knowledge of the history of the language, the sound system, word meaning, variation, social use, and Spanish-language learning to real-world examples. No previous linguistics knowledge is required.

**Prerequisite(s):** SPNS 3101 with a minimum grade of C- or SPNS 3102 with a minimum grade of C- or SPNS 3601 with a minimum grade of C- or SPNS 3603 with a minimum grade of C- or Placement in SPNS 3102 with a score of 3102

**SPNS 3603. Special Topics in Spanish Linguistics. (4 Hours)**

Explores a particular topic in Spanish linguistics. Topics may include phonology, syntax, morphology, sociolinguistics, language contact, bilingualism, or applied linguistics, among others. May be repeated two times.

**Prerequisite(s):** SPNS 3101 with a minimum grade of C- or SPNS 3102 with a minimum grade of C- or SPNS 3601 with a minimum grade of C- or SPNS 3602 with a minimum grade of C- or Placement in SPNS 3102 with a score of 3102

**SPNS 3715. New Narratives: Latin America after 1989. (4 Hours)**

Focuses on film, literature, and new media. This course offers a panoramic view of the Latin American cultural production after 1989, attempting to characterize the variety of styles and trends. Relates the texts and movies to the socio, political, and economic issues of the moment, i.e., implementation of neoliberal democracies, globalization, neocolonialism, resistance, new social movements, etc. Also studies links between Latin America and the United States and between Latin America and Spain. Focuses on texts written by relatively young authors. Taught in Spanish.

**Prerequisite(s):** SPNS 2102 with a minimum grade of D- or SPNS 3101 with a minimum grade of D- or SPNS 3102 with a minimum grade of D-

**SPNS 3720. Literature, Arts, and Poverty in Latin America. (4 Hours)**

Focuses on the construction, characteristics, and representation of poverty/the poor in Latin American texts from the thirties and sixties and in the works of contemporary Latin American writers and film directors. Discusses the relation of these works to a "realist tradition" by studying social, political, and cultural aspects of Latin America from the nineteenth and twentieth centuries. Considers whether we are facing a new kind of realism. Also engages the problem of representation, the "role of literature" (ethics and literature), and its relation with politics and the global economy (literature and the market) in the Latin American context. Taught in Spanish.

**Prerequisite(s):** SPNS 2102 with a minimum grade of D- or SPNS 3101 with a minimum grade of D- or SPNS 3102 with a minimum grade of D-

**Attribute(s):** NUpath Interpreting Culture

**SPNS 3800. Special Topics in Spanish. (1-4 Hours)**

Focuses on specific aspects of Spanish language and culture. May be repeated twice for a maximum of 12 semester hours, when topics vary.

**Prerequisite(s):** SPNS 2102 with a minimum grade of C- or Placement in SPNS 3101 with a score of 3101 or SPNS 3101 with a minimum grade of C- or Placement in SPNS 3102 with a score of 3102 or SPNS 3102 with a minimum grade of C-

**SPNS 3900. Specialized Instruction in Spanish. (1-4 Hours)**

Designed for individuals whose language skills are at an advanced level and who seek specially focused language instruction. Such instruction might be the use of the language in specific settings, or it might be focused on specific conversational nuances of the language. Requires at least an advanced level of competence in the language. May be repeated without limit.

**SPNS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SPNS 4655. Latin American Literature. (4 Hours)**

Offers an overview of the major trends in Latin American narrative, poetry, drama, and essays, from Bernal Diaz through Borges and Bolaño. Studies broad cultural and political contexts, especially the Cold War period and the impact of neoliberalism. Conducted in Spanish.

**Prerequisite(s):** SPNS 2101 with a minimum grade of D- or SPNS 2102 with a minimum grade of D- or SPNS 3101 with a minimum grade of D- or SPNS 3102 with a minimum grade of D-

**Attribute(s):** NUpath Interpreting Culture, NUpath Writing Intensive

**SPNS 4700. Capstone Seminar. (4 Hours)**

Offers a summative research and writing experience for Spanish majors organized around an important critical question in the discipline. Explores practical applications of theories, methods, and practices of critical work on a particular topic while providing students opportunities for reflecting on the connections between their capstone and other work they have done as majors. Conducted in Spanish.

**Prerequisite(s):** SPNS 3102 with a minimum grade of C- or SPNS 3502 with a minimum grade of C-

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**SPNS 4800. Special Topics in Spanish. (1-4 Hours)**

Focuses on specific aspects of Spanish language and culture. May be repeated up to three times with department approval.

**Prerequisite(s):** SPNS 3102 with a minimum grade of C-

**SPNS 4944. Cultural Engagement: Dialogue of Civilizations. (4 Hours)**

Offers an on-site opportunity for students to engage with the culture(s) of Spanish-speaking regions and/or communities. Emphasizes the complexity, transnationalism, and interdisciplinary nature of culture(s). Employs a range of methodological approaches to describe and analyze how cultural practices, objects, texts, and meanings are created, distributed, and exchanged within particular social groups or geographic areas. Students may explore questions of cultural identity, meaning, representation, policy formations, and ideologies. In addition to regular in-class lectures and activities, students have the opportunity to engage in a dialogue with members of the local communities about their perspectives on relevant cultural topics and everyday experiences. May be repeated once. Conducted in Spanish.

**Prerequisite(s):** Placement in SPNS 2101 with a score of 2101 or SPNS 2101 with a minimum grade of C- or Placement in SPNS 2102 with a score of 2102 or SPNS 2102 with a minimum grade of C- or Placement in SPNS 3101 with a score of 3101 or SPNS 3101 with a minimum grade of C- or Placement in SPNS 3102 with a score of 3102 or SPNS 3102 with a minimum grade of C-

**SPNS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SPNS 4992. Directed Study. (1-4 Hours)**

Offers students a way of going beyond work given in the regular curriculum; may also enable students to complete major or minor requirements in certain situations. Priority is given to language majors and to juniors and seniors. May be repeated without limit.

**SPNS 5976. Directed Study. (1 Hour)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**Speech-Language Pathology and Audiology (SLPA)****SLPA 1000. College: An Introduction. (1 Hour)**

Introduces the university, college, and the speech-language pathology and audiology major. Seeks to enhance students' understanding of self and the decisions they make personally, academically, and professionally as members of the university's diverse community. Designed to help students gain knowledge and experiences that will ease the transition to Northeastern University and assist in developing strategies for success in college and in life beyond. Group activities, individual assignments, and active participation in a learning community are designed to help students adjust to life on an urban campus; develop a better understanding of the learning process; acquire essential academic and co-curricular skills; and make connections with faculty, students, and across majors in Bouvé College.

**SLPA 1101. Bridging Minds: Introduction to Speech, Language, and Hearing Sciences. (4 Hours)**

Presents an overview of speech, language, and hearing disorders. Examines assessment and treatment of disorders including a review of normal speech, language, and hearing development. Requires clinical observations of persons with speech, language, and hearing disorders.

**Attribute(s):** NUpath Difference/Diversity, NUpath Natural/Designed World

**SLPA 1102. Language Development. (4 Hours)**

Provides an overview of the development of the language system from birth to adolescence. Students compare different theories of language acquisition and understand their implications for intervention approaches; become familiar with broad developmental stages in infancy and childhood in the domains of motor skills, cognition, social skills, and speech and language, and the connections among these domains; understand the social dynamics between parents and children from which early gestures and prespeech vocalizations emerge; utilize some informal measures of language development covering form, content, and use; and understand broad differences in development in multicultural populations including Asian, Hispanic, and African-American children.

**SLPA 1103. Anatomy and Physiology of Speech and Hearing Mechanism. (4 Hours)**

Offers an in-depth study of the static structure, musculature, and physiology of the speech and hearing mechanism. Emphasizes current research in speech and hearing physiology.

**SLPA 1200. Phonetics. (4 Hours)**

Introduces students to articulatory, perceptual, and linguistic aspects of speech sounds, and phonetic transcription of normal and disordered speech using the International Phonetic Alphabet. Utilizes lectures, discussions, laboratory exercises, demonstrations, readings, audiotape exercises, problem sets, quizzes, and examinations.

**SLPA 1203. Introduction to Audiology. (4 Hours)**

Offers the opportunity to gain knowledge of the physics of sound and the anatomy/physiology of the human hearing mechanism, and how these two areas are interrelated. Familiarizes students with some of the diagnostic tests performed by the audiologist in order to assess the integrity of the hearing mechanism. Concludes with a brief overview of amplification and the rehabilitation process for hearing-impaired individuals.

**SLPA 1205. Speech and Hearing Science. (4 Hours)**

Introduces facts and theories related to the physical bases of sound as relevant to speech acoustics; anatomy of the hearing mechanisms; psychoacoustics; and speech perception. While primarily concerned with normal communication, the course also includes discussion of communication disorders. Lab demonstrations and problem sets augment lectures and discussions.

**SLPA 1555. Communication Disorders in Movies. (4 Hours)**

Seeks to increase student understanding of communication disorders through film. By watching Oscar-awarded, Oscar-nominated, and other Hollywood movies, students are offered an opportunity to develop a heightened sensitivity for how society views specific communication disorders. Through related lectures, discussion, structured activities, and assignments, studies the etiology and diagnosis of a variety of communication disorders and how individuals with these disorders may be helped.

**Attribute(s):** NUpath Natural/Designed World

**SLPA 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SLPA 2000. Introduction to Co-op. (1 Hour)**

Designed to prepare students for all aspects of the cooperative education component of their curriculum by comparing the goals and expectations of the co-op employer, co-op faculty, and students themselves. Offers students an opportunity to obtain an understanding of the policies and procedures of the Department of Cooperative Education through professional goal exploration. Examines the spectrum of clinical settings for speech, language, and hearing professionals, as well as current trends in the job market. Focuses on job search strategies through developing resumés, preparing for interviews, and making informed choices. Examines on-the-job scenarios involving problem solving, ethical issues, and confidentiality and discusses appropriate ways to handle difficult workplace situations.

**SLPA 2400. Neuroscience of Language. (4 Hours)**

Offers an opportunity to examine language and its relation to other domains of science that have historically been studied in isolation, including memory, emotion, sensory processing, decision making, and motivation. Provides an overview of several areas of language, as well as what modern neuroscience teaches about how the brain processes language.

**SLPA 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SLPA 2991. Research in Communication Sciences and Disorders. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision. May be repeated once.

**SLPA 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SLPA 4203. Advanced Audiology. (4 Hours)**

Covers the advanced study of the profession of audiology, including the assessment and treatment of patients with hearing loss, tinnitus, and central auditory processing disorders. Identifies the essential components of working in a clinical practice in order to provide basic audiometric assessments and the selection and fitting of hearing aids and hearing assistive technology for patients with various etiologies.

**Prerequisite(s):** SLPA 1203 with a minimum grade of C

**SLPA 4219. Introduction to Aural Rehabilitation. (3 Hours)**

Introduces the audiological information necessary to conduct aural habilitation and rehabilitation services for patients of all ages relevant to the scope of practice for speech-language pathologists. Introduces topics such as the identification, assessment, diagnosis, and treatment of hearing loss and the associated communication challenges. Offers students an opportunity to learn how to manage hearing loss including an overview of amplification, assistive listening devices, environmental modifications, lip/speech reading techniques, advocacy strategies, teaching strategies, and school/work accommodations.

**Prerequisite(s):** SLPA 1203 with a minimum grade of C

**SLPA 4500. Language Disorders across the Life Span. (4 Hours)**

Offers students an opportunity to obtain the foundation needed to work with children and adults with frequently referred language disorders that are typical consequences of congenital and acquired central and peripheral nervous-system impairments. Emphasizes the anatomy/etiology/neurology/physiology of common disorders, characteristics of these disorders, and intervention approaches (diagnostic and therapeutic). Addresses prevention, outcome, efficacy, and service-delivery considerations.

**Prerequisite(s):** SLPA 1102 with a minimum grade of C

**SLPA 4651. Speech Disorders across the Life Span. (4 Hours)**

Offers students an opportunity to obtain the foundation needed to work with adults and children who demonstrate delays and disorders of speech production across the life span. Discusses articulation and phonological development and disorders, phonological differences, disorders of fluency of speech, and disorders of resonance and voice. Presents formal and informal diagnostic and therapeutic intervention for each disorder/difference and discusses the impact of these communication problems in relation to the individual and family.

**Prerequisite(s):** SLPA 1103 with a minimum grade of C ; SLPA 1200 with a minimum grade of C

**SLPA 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SLPA 4991. Research. (4 Hours)**

Offers an opportunity to conduct research under faculty supervision.

**Attribute(s):** NUpath Integration Experience

**SLPA 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**SLPA 5107. Clinical Procedures. (3-4 Hours)**

Reviews principles and procedures of the functional analysis of behavior and focuses on the application of behavioral theory and research to speech, language, and hearing training. Emphasizes clinical investigation in the experimental analysis of the behavior of communication disorders and experiences in the application of experimental procedures in assessment and treatment programs.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**SLPA 5109. Neurology of Communication. (3 Hours)**

Provides students with the opportunity to acquire a basic understanding of human neuroanatomy and neurophysiology as related to normal aspects of speech, hearing, and language. Reviews central and peripheral nervous system anatomy and physiology developmentally from embryologic through the life span perspectives. Neurology of common speech-language pathologies are similarly addressed.

**SLPA 5152. Early Intervention: Planning and Evaluating Services. (3 Hours)**

Comprises a systematic, family-centered, team approach to service delivery. Cases are used as a focal point for learning how to plan and evaluate individualized family services and group service plans. Covers important aspects of teamwork and leadership in early intervention with respect to service and coordination. Addresses practical approaches to assessing needs for group programs, and evaluating the implementation and outcomes of programs. Also considers the impact of legal and financial issues on service coordination and approaches to service delivery.

**SLPA 5154. Early Intervention Practicum 1. (2 Hours)**

Provides students from school psychology, special education, speech-language pathology and audiology, physical therapy, nursing, and related fields with supervised field work experience in team-oriented interventions for infants and toddlers with disabilities or at risk for developmental delays and their families from linguistically and culturally diverse backgrounds. The practicum class sessions are conceptualized as the linchpin training experience between what the theory addresses in didactic courses and the student's fieldwork. Students are expected to master early intervention and team participation core competencies to work effectively with infants and toddlers and their families, interdisciplinary team members, and administrative personnel.

**SLPA 5155. Early Intervention Practicum 2. (2 Hours)**

Provides students from school psychology, special education, speech-language pathology and audiology, physical therapy, nursing, and related fields with supervised field work experience in team-oriented interventions for infants and toddlers with disabilities or at risk for developmental delays and their families from linguistically and culturally diverse backgrounds. The practicum class sessions are conceptualized as the linchpin training experience between what the theory addresses in didactic courses and the student's fieldwork. Students are expected to master early intervention and team participation core competencies to work effectively with infants and toddlers and their families, interdisciplinary team members, and administrative personnel.

**SLPA 5201. Diagnostic Testing in Speech-Language Pathology. (2 Hours)**

Offers students an opportunity to review diagnostic tests and test manuals in the field of speech-language pathology and to practice their administration. Discusses information about test content, reliability, and validity. Principles of standardized testing, norm referencing, and test scoring are reviewed and practiced.

**SLPA 5300. Intensive Phonetics. (3 Hours)**

Presents foundational concepts related to articulatory, perceptual, and linguistic aspects of speech sounds and phonetic transcription of typical, accented, and disordered speech using the International Phonetic Alphabet, or IPA. Examines speech sound production and perception within the context of clinical application of phonetic analysis.

**SLPA 5302. Intensive Language Development. (3 Hours)**

Presents a foundation in current research and theories regarding the development of first language in children, as well as communication changes relevant to adolescents. Discusses the application of various theoretical perspectives and examines how to recognize examples of communication development in the everyday behavior of children. Emphasizes techniques used to analyze and understand speech and language performance.

**SLPA 5303. Intensive Anatomy and Physiology of Speech and Hearing Mechanism. (3 Hours)**

Presents an in-depth study of the static structure, musculature, and physiology of the speech and hearing mechanism. Analyzes the specific structures, muscles, and functions of the respiratory, phonatory, articulatory, and hearing systems. Emphasizes the current research in speech and hearing physiology.

**SLPA 5305. Intensive Speech and Hearing Science. (3 Hours)**

Examines the principles of speech and hearing science, focusing on the analysis and interpretation of sound waves and their role in communication. Studies how to differentiate between wave patterns, measure and describe sound wave properties, and understand how speech signals are generated. Emphasizes analysis of spectrograms, integration of acoustic measurements in assessment and treatment, and application of theoretical knowledge to clinical practice.

**SLPA 5403. Applied Foundations of Audiology. (3 Hours)**

Presents the foundational knowledge and skills to work with individuals who are deaf or hard of hearing. Describes the history and current requirements of the audiology profession. Examines the anatomy and physiology of the auditory mechanism and discusses the subjective and objective assessments used for diagnosis. Provides instruction how to recognize the types, degrees, and etiology of various hearing losses; understand and differentiate amplification options; interpret audiograms; and analyze cases to formulate recommendations.

**SLPA 5976. Directed Study. (1-4 Hours)**

Allows students to pursue topics of individual interest beyond the scope of formal course work under the direction of faculty. May be repeated without limit.

**SLPA 6211. Research and Evidence-Based Practice. (3 Hours)**

Uses principles of evidence-based practice to prepare students primarily as consumers of clinically relevant research in the field of communication disorders. While consumers utilize research information in some shape or form in their daily practice, producers engage in the conduct of original or replicated research. Consumers and producers of research information should be concerned with internal and external validity of research. As consumers, for example, clinicians may consult research studies to determine suitable treatments for their clients. As producers, clinicians may document a treatment via the case study method or single-subject experimental research. Emphasizes the role of using research to guide practice, even though the role of clinicians as research producer is addressed as well.

**SLPA 6219. Aural Rehabilitation. (3 Hours)**

Provides a detailed examination of various approaches to speech reading and auditory training as they apply to children and adults. Offers an integrated approach to management of hearing-impaired individuals.

**SLPA 6300. Speech Science. (2 Hours)**

Focuses on the basics of acoustics and its relationship with speech production and speech perception. Highlights the relationship between physiological aspects of speech production and their influence on the resulting acoustics of speech. Considers both normative and disordered speech production and perception. Discusses acoustic analysis and clinical approaches to remediation.

**SLPA 6303. Stuttering. (3 Hours)**

Provides students with the information base needed to work with individuals of all ages who present with any type of fluency disorder. Focuses on theoretical background and assessment/treatment techniques for dysfluent individuals. Emphasizes outcome and efficacy considerations.

**SLPA 6304. Augmentative and Alternative Communication. (3 Hours)**

Provides an overview of augmentative and alternative communication (AAC) approaches for individuals with severe communication impairments. Helps students gain the foundation knowledge and skills for further independent study, continuing education, further course work, and practicum experience. For student who seek additional study or experience in AAC, the course should provide an enabling foundation for providing direct services in AAC or to serve as a consultant to meet the needs of individuals with severe communication impairments. For those who will not seek additional study in AAC, the course should provide the basic knowledge for appropriate referral and collaboration.

**SLPA 6305. Articulation and Phonology. (3 Hours)**

Familiarizes students with theoretical, empirical, and practical views of the etiology, assessment, and treatment of disorders of the speech sound system. Focuses on disorders that are developmental in nature (as opposed to emerging after normal speech sound development has occurred). Includes a review of articulatory phonetics, discussion of relevant linguistic principles, and study of theory and data relevant to the course of normal speech sound system development.

**SLPA 6307. Voice Disorders. (3 Hours)**

Examines voice disorders, which are prevalent across the life span in both professional and lay voice users. Evaluation and treatment of organic and/or functional vocal pathologies are key focuses of speech-language pathologists across clinical settings (educational and medical). Provides students with the information base needed to work with these interesting and rewarding populations. Emphasis is on anatomy and physiology of normal and impaired voice production, instrumental and noninstrumental assessment, and treatment techniques for remediation. Emphasizes prevention, outcome, and efficacy considerations.

**SLPA 6308. Dysphagia. (3 Hours)**

Evaluating and treating swallowing disorders are key focuses of the speech-language pathologies in most clinical work settings (educational and medical), with individuals of all ages. Provides students with the information base needed to work with these challenging and rewarding populations. Focuses on theoretical background and assessment/treatment techniques for dysphagia individuals. Emphasizes outcome and efficacy considerations.

**SLPA 6311. Counseling in SLP. (3 Hours)**

Provides students with a theoretical framework from which specific counseling strategies may be implemented for individuals and their families with various communication disorders. Stresses conversational interactive strategies.

**SLPA 6313. Counseling in Speech-Language Pathology. (2 Hours)**

Offers a theoretical framework from which specific counseling strategies may be implemented for individuals and their families with various communication disorders. Stresses conversational interactive strategies. Emphasizes the role of cultural humility and cultural responsiveness in counseling strategies. Offers students an opportunity to role-play counseling issues with individuals across the life span.

**SLPA 6320. Autism. (1 Hour)**

Reviews the autism spectrum, including theories of causation, developmental aspects, descriptive and diagnostic characteristics, an overview of assessment and intervention, and legal and social issues as they relate to speech-language pathologists. Presents the most current research findings and best practices needed to gain a clear understanding of individuals diagnosed with autism and how to apply current research to treatment.

**SLPA 6321. Motor Speech Disorders. (3 Hours)**

Focuses on the neurology, SLP evaluation, and SLP treatment of individuals presenting with any type/types of anarthria/dysarthria and apraxia/dyspraxia of speech. Many of the neurologically impaired children and adults that speech-language pathologists work with present with motor speech disorders. Diagnostically, studies how to complete oral motor examinations (including an assessment of those cranial nerves involved in respiration, phonation, resonance, and articulation) and intelligibility testing. Therapeutically, studies a variety of therapy approaches for the range of motor speech disorders based on severity of impairment and prognosis for recovery/improvement including verbal, nonverbal, prosthetic, and pharmacologic.

**SLPA 6325. Accent Modification for Speech-Language Pathology. (1 Hour)**

Offers a professional-level introduction to content, processes, and practices associated with accent modification (AM) and "speech coaching" for clients who present with communication differences that are not considered pathologic. Seeks to facilitate consideration and discussion of cultural-linguistic, ethical, business, and other related factors. Offers student clinicians opportunities to observe and to practice various assessment and training approaches in accent modification and speech training and to demonstrate their knowledge and skills through the development of a practical training plan.

**SLPA 6329. Diversity, Equity, and Inclusion in Speech-Language Pathology. (2 Hours)**

Introduces intersectional thinking and cultural responsiveness for speech-language pathologists through topics related to diversity, equity, and inclusion. Offers students an opportunity to gain comfort in engaging with these topics and to develop actionable steps toward more reflective and accountable practices. Facilitates engagement in culturally responsive care through participation in the process of unlearning and understanding the needs of diverse populations.

**SLPA 6332. Seminar in Communication Disorders. (1-3 Hours)**

Allows for the advanced study of current diagnostic and intervention strategies, applications of theoretical and applied research, and exploration of current topics in speech-language pathology. Topics may range from the treatment of undeserved populations to the analysis of complex clinical cases requiring interdisciplinary management. May be repeated twice.

**SLPA 6339. Language Literacy in Practice. (1 Hour)**

Focuses on early literacy skill acquisition in the field of speech-language pathology. Introduces the historical framework of learning to read, elements of reading, reading assessment and intervention, and the integration of theoretical knowledge and clinical experience in school-based therapy settings. Offers students an opportunity for hands-on delivery of language-based early literacy services to young school-age children who may be at risk for delayed language and/or early reading difficulties.

**SLPA 6340. Language Disorders in Children 1. (3 Hours)**

Explores communication disorders from infancy through the preschool period. Considers at-risk populations, as well as those with known etiologies. Addresses information on incidence, characteristics, principles and methods of assessment and intervention, multicultural issues, service delivery models, and current issues in the research literature. Examines theoretical issues and their implication for language intervention.

**SLPA 6341. Language Disorders in Children 2. (3 Hours)**

Offers students an opportunity to obtain a foundation of knowledge about the etiology and characteristics of language disorders in school-age children. Addresses the evolving language demands children encounter as they progress through school, the impact of language disorders on academic performance and social interaction in the classroom, the relationship between oral and written language development, as well as the role of the speech-language pathologist in the assessment and treatment of written language disorders. Also designed to teach students in the field of communication disorders about literacy skill use and evaluation and treatment of literacy impairments beyond early childhood.

**SLPA 6342. Speech-Language Disorders In Adults 1. (3 Hours)**

Offers students an opportunity to obtain foundational skills needed to work with frequently referred adults with aphasia across clinical settings. Speech, language, and cognitive-communication disorders are typical consequences of acquired central and peripheral nervous system adult impairments. Emphasizes the anatomy, etiology, neurology, and physiology of different types of aphasia, characteristics of these, and intervention approaches (diagnostic and therapeutic). Addresses prevention, outcome, efficacy, and service-delivery considerations.

**Prerequisite(s):** SLPA 5109 with a minimum grade of B or SLPA 5109 with a minimum grade of B

**SLPA 6343. Speech-Language Disorders in Adults 2. (3 Hours)**

Offers students an opportunity to obtain foundational skills needed to work with frequently referred adults with acquired neurologic cognitive-communicative impairments across clinical settings. Speech, language, and cognitive-communication disorders are typical consequences of acquired central and peripheral nervous system adult impairments. Emphasizes the anatomy, etiology, neurology, and physiology of different types of cognitive-communicative impairments, characteristics of these, and intervention approaches (diagnostic and therapeutic). Addresses prevention, outcome, efficacy, and service-delivery considerations.

**Prerequisite(s):** SLPA 5109 with a minimum grade of B or SLPA 5109 with a minimum grade of B

**SLPA 6350. Speech-Language Pathology in Medical Settings. (2 Hours)**

Provides an overview to the adult and pediatric medical settings in which speech-language pathologists are employed. Offers students an opportunity to learn about the role(s) of the SLP in various settings (e.g., acute care, rehabilitation, outpatient services, private practice, home health, and day habilitation); the SLPs' scope of practice; the variety of patient populations/diagnoses; and the medical team approach to service delivery across the continuum of care and across the life span.

**SLPA 6360. Diversity, Equity, and Inclusion in Speech-Language Pathology. (3 Hours)**

Introduces intersectional thinking and cultural responsiveness for speech-language pathologists through topics related to diversity, equity, and inclusion (DEI). Offers an opportunity to build mastery with these topics and to develop actionable steps towards more reflective and accountable practices. Facilitates engagement in culturally responsive care through participating in the process of unlearning and applying the needs of diverse populations, while navigating implicit bias. Provides opportunities to apply theoretical knowledge to practical contexts to develop the skills needed to identify and analyze key challenges, explore possible solutions, and implement transformative, equity-driven practices in the field.

**SLPA 6415. Speech-Language Pathology Advanced Clinical Practicum 1. (3 Hours)**

Offers supervised clinical experience in speech-language pathology for beginning graduate students at Northeastern University on-campus clinics. Requires student to be available a minimum of twenty-five hours per week during the academic year. Requires attendance at on-campus seminar meetings held weekly. May be repeated twice.

**Prerequisite(s):** SLPA 5107 with a minimum grade of B or SLPA 5107 with a minimum grade of B

**SLPA 6416. Speech-Language Pathology Advanced Clinical Practicum 2. (2 Hours)**

Offers supervised clinical experience in speech-language pathology for students at Northeastern University on-campus clinics and off-campus practicum sites. Uses practical experience to emphasize advanced diagnostic and therapeutic techniques, stressing the application of theory to practice. Requires student to be available a minimum of twenty-five hours per week during the academic year. Requires attendance at weekly on-campus seminar meetings. May be repeated once.

**Prerequisite(s):** SLPA 6415 with a minimum grade of S or SLPA 6415 with a minimum grade of S

**SLPA 6417. Speech-Language Pathology Advanced Clinical Practicum 3. (2 Hours)**

Offers supervised clinical experience in speech-language pathology for advanced graduate students at Northeastern University on-campus clinics and off-campus practicum sites. Uses practical experience to emphasize advanced diagnostic and therapeutic techniques, stressing continued integration of theory to practice. Requires students to be available a minimum of twenty-five hours per week during the academic year. Requires attendance at weekly on-campus seminar meetings. May be repeated once.

**Prerequisite(s):** SLPA 6416 with a minimum grade of S

**SLPA 6418. Speech-Language Pathology Advanced Clinical Practicum 4. (2 Hours)**

Offers supervised clinical experience in speech-language pathology for advanced graduate students at the Northeastern University on-campus clinics and off-campus practicum sites. Uses practical experience to emphasize advanced diagnostic and therapeutic techniques, stressing continued application of theory to practice. Requires students to be available a minimum of twenty hours per week during the academic year. Requires attendance at weekly on-campus seminar meetings. May be repeated once.

**Prerequisite(s):** SLPA 6417 with a minimum grade of S

**SLPA 6420. Practical Statistics for Speech-Language Pathology. (3 Hours)**

Introduces basic concepts in data collection, organization, and analysis using statistical methods with an overall focus on profession-specific application and interpretation.

**SLPA 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SLPA 6964. Co-op Work Experience. (0 Hours)**

Provides eligible students with an opportunity for work experience. May be repeated once for a total of two completions.

**SLPA 6990. Thesis. (1-3 Hours)**

Offers a research activity that is the first of a two-course thesis sequence with the recommendation of the advisor. May be repeated twice for a maximum of 6 semester hours.

**Strategic Intelligence and Analysis - CPS (SIA)**

**SIA 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SIA 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SIA 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SIA 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SIA 6010. Intelligence Operations Management. (3 Hours)**

Examines intensively case studies of intelligence operations engaged in by the United States and other countries. Uses several recent case studies, such as Operation Iraqi Freedom (OIF). Examines analysis and conceptual design of the operation, the strategic basis of the policy, as well as the operational- and tactical-level experiences. Offers students an opportunity to learn how intelligence fits in the strategic, operational, and tactical levels of OIF and the challenges in bringing the nation's intelligence assets together in a coherent and effective manner.

**SIA 6020. Intelligence in a Globalized World. (3 Hours)**

Highlights the key themes that are currently developing within international intelligence liaison relationships. Explores the trend towards homogenization of intelligence and other law enforcement and security initiatives. Offers students an opportunity to discuss international standardization among a widening group of partners and how these processes may establish viable frameworks and operational parameters for the intelligence liaison arrangements, together with addressing counterintelligence and other security considerations. In short, a best-practice approach is defined and explored as becoming normalized operationally, facilitating the optimization of intelligence liaison arrangements.

**SIA 6030. Intelligence Analysis and Policy Relationship. (3 Hours)**

Describes how relationships are forged and fostered between policymakers and intelligence analysts. Policymakers need support from intelligence to help deal with uncertainty. Thus, policy officials come to respect and rely on analysts and managers who appreciate this aspect of the decision process. Analysts are deemed most useful when they clarify what is known by laying out the evidence and pointing to cause-and-effect patterns; carefully structure assumptions and argumentation about what is unknown and unknowable; and bring expertise to planning and action on important threats and opportunities. The heavily engaged policymaker has little use for intelligence products that emphasize prediction over explanation and opinion over evidence by assessments that trivialize the challenge of uncertainty by burying honest debate in compromise language and by ignoring high-impact contingencies.

**SIA 6040. The Intelligence Community and Interagency Collaboration. (3 Hours)**

Offers an overview of the disparate intelligence agencies in the intelligence community and describes their missions, responsibilities, and how agencies do or do not collaborate in today's environment. Given the dynamic nature of threats and sources in the 21st century, this course reflects the rapid changes taking place. Requires students to analyze the relative missions and develop policy recommendations for future collaborative efforts in keeping with relevant U.S. and international laws.

**SIA 6050. All-Source Intelligence. (4 Hours)**

Offers students an opportunity to examine several means of collecting and analyzing multidiscipline information but remain focused on the need and ability to filter all of this data into objective and cohesive all-source products with an unbiased viewpoint. To provide the current and thorough intelligence analysis required today by senior policymakers, military leadership, and corporate America, all-source analysts utilize many types of intelligence: human, imaginary, signals, electronic, telemetry, communications, measurement and signals, and open-source. Professional analysts also use a variety of linking, modeling, and data-manipulation or artificial intelligence software packages.

**SIA 6060. Human Intelligence Operations. (4 Hours)**

Introduces all aspects of human intelligence (HUMINT), from its basic role as part of the intelligence community to operational considerations as a tool of U.S. national security policy. Studies what HUMINT is, how it is conducted, its challenges, specific analytical and reporting considerations that make it a unique discipline, and some of its great successes. Explores contemporary challenges to conducting HUMINT operations, given technology and the ways different U.S. government intelligence agencies organize and operate their HUMINT capabilities. Offers students an opportunity to develop advanced analytical and writing skills and to obtain a basis for dissertation research and writing. Requires students to research information from other disciplines and integrate it into their current research and applied decision making on HUMINT operations supporting counterterrorism.

**SIA 6070. Analysis for Counterterrorism. (4 Hours)**

Explores how to create a unified, integrated, and multidisciplinary counterterrorism analysis program that makes the best use of all available resources. The task of counterterrorism is one that is particularly analysis intensive. It requires its practitioners to employ a melded set of analytical tools and interoperable capabilities. This objective can be complicated by the fact that many counterterrorism operations might involve several entities, including both the intelligence community and unclassified counterterrorism efforts.

**SIA 6140. Civil Liberties and Security. (3 Hours)**

Examines and discusses important constitutional issues that affect U.S. citizens. Emphasizes the rights and civil liberties that the U.S. Constitution protects. Explores the history and makeup of the U.S. Supreme Court and the important role the court plays in ensuring democracy continues to function. Analyzes the distribution of powers among the three coordinate branches of government—legislative, executive, and judicial—and engages students in understanding the laws and policies that govern critical constitutional issues.

**SIA 6150. Corporate Security and Investigations. (3 Hours)**

Explores the essentials of private and public investigations in a corporate environment. Focuses on the comprehensive study of the investigative process, tools of investigations, and types of investigations. Includes an examination of fraud detection, risk assessment, employee theft, insider threat, embezzlement, accounting improprieties, compliance investigations, internal controls, and safeguards to prevent these threats.

**SIA 6160. Information Systems Policy. (3 Hours)**

Explores current threats to information security from internal and external actors, how organizations have reacted to such threats, and best practices in organizational design to minimize threats. Examines a systematic and practical approach for establishing, managing, and operating a comprehensive information assurance program and ensuring continuity of operations.

**SIA 6170. Counterintelligence. (3 Hours)**

Presents a comprehensive overview of counterintelligence (CI) and how intelligence agencies, organizations, and military units in the United States use both offensive and defensive CI to guard and protect U.S. national security interests from foreign intelligence entities. Explores multidisciplinary CI support to intelligence operations through historical analysis and case studies. Reviews and analyzes how cultural, social, and technological changes affect CI.

**SIA 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SIA 6980. Capstone. (3 Hours)**

Offers students an opportunity to increase their impact and effectiveness as a leader working on a real problem set for a real consumer of information in the security and intelligence studies field. Explores and analyzes global security and intelligence threats, such as threats to national security, homeland security, and cybersecurity. Culminates in a team-based experiential project.

**SIA 6983. Topics in Strategic Intelligence and Analysis. (1-4 Hours)**

Introduces selected and substantive issues in homeland security. Topics vary from one offering of the course to the next. May be repeated up to seven times for up to 8 total credits.

**Prerequisite(s):** SIA 6000 with a minimum grade of C ; SIA 6010 with a minimum grade of C ; SIA 6020 with a minimum grade of C ; SIA 6030 with a minimum grade of C

**SIA 7990. Thesis. (1-4 Hours)**

Offers thesis supervision by members of the department.

**Prerequisite(s):** SIA 6000 (may be taken concurrently) with a minimum grade of C- ; SIA 6010 (may be taken concurrently) with a minimum grade of C- ; SIA 6020 (may be taken concurrently) with a minimum grade of C- ; SIA 6030 (may be taken concurrently) with a minimum grade of C- ; GST 6109 (may be taken concurrently) with a minimum grade of C-

**Strategy (STRT)****STRT 3301. Multinational Corporations and Global Sustainability: Complexities, Strategies, and Societal Impact. (4 Hours)**

Explores the role of multinational corporations and their leaders in addressing key sustainability challenges including climate change, wealth inequality, and human rights concerns. Examines how multinationals, with their vast resources and global influence, are uniquely positioned to address global sustainability issues through management practices and actionable strategies. Investigates how national rules, norms, and cultural beliefs shape the responses of multinationals and influence their ability to drive positive change in society.

**STRT 4301. Strategic Analysis and Decision Making. (4 Hours)**

Examines key components of strategic decision making in-depth. Strategic decision making involves solving complex business problems to achieve company objectives within a competitive context. Topics covered include understanding the competitive environment, managing uncertainty, identifying and evaluating resource allocation alternatives, and creating action plans to implement strategic decisions. Emphasizes critical thinking and making decisions with incomplete information in a competitive environment.

**STRT 4501. Strategy in Action. (4 Hours)**

Introduces and describes the tools necessary to analyze, formulate, and implement business strategy in today's uncertain and volatile world. Provides a dynamic, global, cross-functional perspective across traditional, platform, digital, and other cutting-edge businesses. Offers students an opportunity to sharpen their ability to think strategically at multiple levels, including overall strategies, major firm activities, and specific actions. Examines the drivers of sustained superior performance in the face of rapidly changing markets, technologies, societies, and geopolitics. Offers a capstone experience that translates into real-world strategic situations.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**STRT 4509. Strategic Management. (4 Hours)**

Presents a general management perspective on business strategy, the "big picture." Illustrates how a well-thought-out strategy can lead to sustained, superior performance by firms in a dynamic business environment. Offers students an opportunity to obtain a broad understanding of the importance and complexity of strategic decisions from a practical and problem-oriented approach. Applies concepts, analytic frameworks, and intuition to the strategic issues that real-world companies face.

**STRT 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of faculty members of the department on a chosen topic. Course content depends on instructor. May be repeated up to three times for a maximum of 8 semester hours.

**STRT 6200. Strategic Decision Making in a Changing Environment. (3 Hours)**

Focuses on strategy development and implementation for a line of business and for the corporation as a whole by adopting a top management perspective. Beginning with developing a mission statement and goals for the firm, focuses on environmental scanning, incorporating economic, technological, sociopolitical, and legal trends in conducting industry analysis, thus assessing opportunities and threats and the firm's capabilities before formulating strategy that represents a fit between the environment and the firm. Discusses how to develop competitive advantage and assess competitive positioning, and studies how organizational structure and systems contribute to implementing strategy. Stresses the role of leadership and motivation before moving on to feedback mechanisms to assess success in strategy implementation, leading to revision of strategic plans as needed.

**STRT 6210. Workforce Metrics and Analytics. (3 Hours)**

Introduces how to measure and manage a workforce strategically, including (1) identifying the strategic work that is truly necessary to execute firm strategy; (2) investing in differentiated management systems that support that work; and (3) designing and implementing targeted measurement systems, such as human resources function and workforce scorecards, designed to help to hold line managers accountable for strategic talent. Emphasizes helping students move from a focus on levels associated with a particular workforce attribute (e.g., what is our cost per hire?) to understanding the impact of the workforce on business-level outcomes (e.g., how might an increase in the quality of our project managers affect new product cycle time?).

**STRT 6220. Strategic Management for Healthcare Organizations. (3 Hours)**

Offers students an opportunity to understand general business strategy concepts as they relate to the healthcare industry. Explores how to analyze market opportunities and challenges as they apply to various healthcare organizations, such as hospitals, physician organizations, and nursing homes. Presents and discusses analytical frameworks for making strategic decisions, drawing on different disciplines, including economics, management, and psychology. Strategic issues include mergers and acquisitions, vertical integration, joint ventures and alliances, performance-control systems, and organizational design.

**STRT 6224. Managing the Sustainable Global Enterprise. (3 Hours)**

Examines the role of multinational companies and their business leaders in addressing the sustainability challenges of our time as well as the nature of these challenges. Analyzes the changing role of corporations in society and their potential for multistakeholder collaborations to bring about positive societal change. Explores best management practices for addressing sustainability issues in a global context and how different national rules, norms, and beliefs shape multinational companies' ability and willingness to take on the role of positive change agents in society.

**STRT 6318. Strategic Planning for the Future. (2 Hours)**

Provides the fundamental concepts for understanding and managing strategy in a competitive context. Focuses on analysis, critical thinking, and making strategic decisions. Discusses the analytical tools to understand the industry and firm context. Explores the design and execution of strategies to compete successfully. Investigates the strategic changes involved as firms grow and expand into new businesses and geographic markets.

**STRT 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**STRT 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated once.

## Study Abroad (ABRD)

### **ABRD 5100. International Study—Sweden. (20 Hours)**

Offers an opportunity to study in Sweden. May be repeated without limit.

### **ABRD 5101. International Study—Australia. (20 Hours)**

Offers an opportunity to study in Australia. May be repeated without limit.

### **ABRD 5102. International Study—Belgium. (20 Hours)**

Offers an opportunity to study in Belgium. May be repeated without limit.

### **ABRD 5103. International Study—Egypt. (20 Hours)**

Offers an opportunity to study in Egypt. May be repeated without limit.

### **ABRD 5104. International Study—Israel. (20 Hours)**

Offers an opportunity to study in Israel. May be repeated without limit.

### **ABRD 5105. International Study—England. (20 Hours)**

Offers an opportunity to study in England. May be repeated without limit.

### **ABRD 5106. International Study—Ireland. (20 Hours)**

Offers an opportunity to study in Ireland. May be repeated without limit.

### **ABRD 5107. International Study—Northern Ireland. (20 Hours)**

Offers an opportunity to study in Northern Ireland. May be repeated without limit.

### **ABRD 5108. International Study—Ghana. (20 Hours)**

Offers an opportunity to study in Ghana. May be repeated without limit.

### **ABRD 5109. International Study—Spain. (20 Hours)**

Offers an opportunity to study in Spain. May be repeated without limit.

### **ABRD 5110. International Study—Canada. (20 Hours)**

Offers an opportunity to study in Canada. May be repeated without limit.

### **ABRD 5111. International Study—Mexico. (20 Hours)**

Offers an opportunity to study in Mexico. May be repeated without limit.

### **ABRD 5112. International Study—Czech Republic. (20 Hours)**

Offers an opportunity to study in the Czech Republic. May be repeated without limit.

### **ABRD 5113. International Study—Italy. (20 Hours)**

Offers an opportunity to study in Italy. May be repeated without limit.

**ABRD 5114. International Study—South Africa. (20 Hours)**

Offers an opportunity to study in South Africa. May be repeated without limit.

**ABRD 5115. International Study—SEA Education. (20 Hours)**

Offers an opportunity to study under the auspices of the Sea Education Association. May be repeated without limit.

**ABRD 5116. International Study—Singapore. (20 Hours)**

Offers an opportunity to study in Singapore. May be repeated without limit.

**ABRD 5117. International Study—France. (20 Hours)**

Offers an opportunity to study in France. May be repeated without limit.

**ABRD 5118. International Study—New Zealand. (20 Hours)**

Offers an opportunity to study in New Zealand. May be repeated without limit.

**ABRD 5119. International Study—Vietnam. (20 Hours)**

Offers an opportunity to study in Vietnam. May be repeated without limit.

**ABRD 5140. International Study—Argentina. (20 Hours)**

Offers an opportunity to study in Argentina. May be repeated without limit.

**ABRD 5141. International Study—Chile. (20 Hours)**

Offers an opportunity to study in Chile. May be repeated without limit.

**ABRD 5142. International Study—China. (20 Hours)**

Offers an opportunity to study in China. May be repeated without limit.

**ABRD 5143. International Study—Costa Rica. (20 Hours)**

Offers an opportunity to study in Costa Rica. May be repeated without limit.

**ABRD 5144. International Study—Middle East. (20 Hours)**

Offers an opportunity to study in the Middle East. May be repeated without limit.

**ABRD 5145. International Study—Japan. (20 Hours)**

Offers an opportunity to study in Japan. May be repeated without limit.

**ABRD 5146. International Study—Scotland. (20 Hours)**

Offers an opportunity to study in Scotland. May be repeated without limit.

**ABRD 5147. International Study—Greece. (20 Hours)**

Offers an opportunity to study in Greece. May be repeated without limit.

**ABRD 5148. International Study—Dominican Republic. (20 Hours)**

Offers an opportunity to study in the Dominican Republic. May be repeated without limit.

**ABRD 5150. International Study—Denmark. (20 Hours)**

Offers an opportunity to study in Denmark. May be repeated without limit.

**ABRD 5151. International Study—Turkey. (20 Hours)**

Offers an opportunity to study in Turkey. May be repeated without limit.

**ABRD 5152. International Study—Thailand. (20 Hours)**

Offers an opportunity to study in Thailand. May be repeated without limit.

**ABRD 5153. International Study—Netherlands. (20 Hours)**

Offers an opportunity to study in the Netherlands. May be repeated without limit.

**ABRD 5154. International Study—Central Europe. (20 Hours)**

Offers an opportunity to study in Central Europe. May be repeated without limit.

**ABRD 5155. International Study—Switzerland. (20 Hours)**

Offers an opportunity to study in Switzerland. May be repeated without limit.

**ABRD 5156. International Study—Peru. (20 Hours)**

Offers an opportunity to study in Peru. May be repeated without limit.

**ABRD 5157. International Study—Hungary. (20 Hours)**

Offers an opportunity to study in Hungary. May be repeated without limit.

**ABRD 5158. International Study—Korea. (20 Hours)**

Offers an opportunity to study in Korea. May be repeated without limit.

**ABRD 5159. International Study—Russia. (20 Hours)**

Offers an opportunity to study in Russia. May be repeated without limit.

**ABRD 5160. International Study—Brazil. (20 Hours)**

Offers an opportunity to study in Brazil. May be repeated without limit.

**ABRD 5161. International Study—Iceland. (20 Hours)**

Offers an opportunity to study in Iceland. May be repeated without limit.

**ABRD 5162. International Study—Benin. (20 Hours)**

Offers an opportunity to study in Benin. May be repeated without limit.

**ABRD 5163. International Study—Cuba. (20 Hours)**

Offers an opportunity to study in Cuba. May be repeated without limit.

**ABRD 5164. International Study—India. (20 Hours)**

Offers an opportunity to study in India. May be repeated without limit.

**ABRD 5165. International Study—Caribbean. (20 Hours)**

Offers an opportunity to study in the Caribbean. May be repeated without limit.

**ABRD 5166. International Study—Armenia. (20 Hours)**

Offers an opportunity to study in Armenia. May be repeated without limit.

**ABRD 5167. International Study—Morocco. (20 Hours)**

Offers an opportunity to study in Morocco. May be repeated without limit.

**ABRD 5168. International Study—Germany. (20 Hours)**

Offers an opportunity to study in Germany. May be repeated without limit.

**ABRD 5169. International Study—Serbia. (20 Hours)**

Offers an opportunity to study in Serbia. May be repeated without limit.

**ABRD 5170. International Study—Austria. (20 Hours)**

Offers an opportunity to study in Austria. May be repeated without limit.

**ABRD 5171. International Study—Lebanon. (20 Hours)**

Offers an opportunity to study in Lebanon. May be repeated without limit.

**ABRD 5172. International Study—Senegal. (20 Hours)**

Offers an opportunity to study in Senegal. May be repeated without limit.

**ABRD 5173. International Study—South Korea. (20 Hours)**

Offers an opportunity to study in South Korea. May be repeated without limit.

**ABRD 5174. International Study—Kenya. (20 Hours)**

Offers an opportunity to study in Kenya. May be repeated without limit.

**ABRD 5175. International Study—Syria. (20 Hours)**

Offers an opportunity to study in Syria. May be repeated without limit.

**ABRD 5176. International Study—Balkans. (20 Hours)**

Offers an opportunity to study in the Balkans. May be repeated without limit.

**ABRD 5177. International Study—Uganda. (20 Hours)**

Offers an opportunity to study in Uganda. May be repeated without limit.

**ABRD 5178. International Study—Rwanda. (20 Hours)**

Offers an opportunity to study in Rwanda. May be repeated without limit.

**ABRD 5179. International Study—Wales. (20 Hours)**

Offers an opportunity to study in Wales. May be repeated without limit.

**ABRD 5180. International Study—Portugal. (20 Hours)**

Offers an opportunity to study in Portugal. May be repeated without limit.

**ABRD 5181. International Study—Indonesia. (20 Hours)**

Offers an opportunity to study in Indonesia. May be repeated without limit.

**ABRD 5182. International Study—Trinidad and Tobago. (20 Hours)**

Offers an opportunity to study in Trinidad and Tobago. May be repeated without limit.

**ABRD 5183. International Study—Jordan. (20 Hours)**

Offers an opportunity to study in Jordan. May be repeated without limit.

**ABRD 5184. International Study—Ecuador. (20 Hours)**

Offers an opportunity to study in Ecuador. May be repeated without limit.

**ABRD 5185. International Study—Tunisia. (20 Hours)**

Offers an opportunity to study in Tunisia. May be repeated without limit.

**ABRD 5186. International Study—Cameroon. (20 Hours)**

Offers students an opportunity to study in Cameroon. May be repeated without limit.

**ABRD 5187. International Study—Zambia. (20 Hours)**

Offers students an opportunity to study in Zambia. May be repeated without limit.

**ABRD 5188. International Study—Taiwan. (20 Hours)**

Offers students an opportunity to study in Taiwan. May be repeated without limit.

**ABRD 5189. International Study—Poland. (20 Hours)**

Offers students an opportunity to study in Poland. May be repeated without limit.

**ABRD 5190. International Study—Iran. (20 Hours)**

Offers an opportunity to study in Iran. May be repeated without limit.

**ABRD 5191. International Study—Bonaire. (20 Hours)**

Offers students an opportunity to study in Bonaire. May be repeated without limit.

**ABRD 5192. International Study—Grenada. (20 Hours)**

Offers students an opportunity to study in Grenada. May be repeated without limit.

**ABRD 5193. International Study—Tanzania. (20 Hours)**

Offers students an opportunity to study in Tanzania. May be repeated without limit.

**ABRD 5195. International Study—Lithuania. (20 Hours)**

Offers students an opportunity to study in Lithuania. May be repeated without limit.

**ABRD 5196. International Study—Oman. (20 Hours)**

Offers students an opportunity to study in Oman. May be repeated without limit.

**ABRD 5197. International Study—Bhutan. (20 Hours)**

Offers students an opportunity to study in Bhutan. May be repeated without limit.

**ABRD 5198. International Study—Jamaica. (20 Hours)**

Offers students an opportunity to study in Jamaica. May be repeated without limit.

**ABRD 5199. International Study—Finland. (20 Hours)**

Offers students an opportunity to study in Finland. May be repeated without limit.

**ABRD 5200. International Study—Norway. (20 Hours)**

Offers students an opportunity to study in Norway. May be repeated without limit.

**ABRD 5201. International Study—Kazakhstan. (20 Hours)**

Offers students an opportunity to study in Kazakhstan. May be repeated without limit.

**ABRD 5202. International Study—Botswana. (20 Hours)**

Offers students an opportunity to study in Botswana. May be repeated without limit.

**ABRD 5203. International Study—United States. (20 Hours)**

Offers students an opportunity to study in the United States. May be repeated without limit.

**ABRD 5204. International Study—Croatia. (20 Hours)**

Offers students an opportunity to study in Croatia. May be repeated without limit.

**ABRD 5205. International Study—Panama. (20 Hours)**

Offers students an opportunity to study in Panama. May be repeated without limit.

**ABRD 5206. International Study—Bolivia. (20 Hours)**

Offers students an opportunity to study in Bolivia. May be repeated without limit.

**ABRD 5207. International Study—Romania. (20 Hours)**

Offers students an opportunity to study in Romania. May be repeated without limit.

**ABRD 5208. International Study—Belize. (20 Hours)**

Offers students an opportunity to study in Belize. May be repeated without limit.

**ABRD 5209. International Study—Kuwait. (20 Hours)**

Offers students an opportunity to study in Kuwait. May be repeated without limit.

**ABRD 5210. International Study—French Polynesia. (20 Hours)**

Offers an opportunity to study in French Polynesia. May be repeated without limit.

**ABRD 5211. International Study—Georgia. (20 Hours)**

Offers an opportunity to study in Georgia. May be repeated without limit.

**ABRD 5212. International Study—Uzbekistan. (20 Hours)**

Offers an opportunity to study in Uzbekistan. Maybe repeated without limit.

**ABRD 5213. International Study: Cambodia. (20 Hours)**

Offers an opportunity to study in Cambodia. Maybe repeated without limit.

**ABRD 5214. International Study: Nepal. (20 Hours)**

Offers an opportunity to study in Nepal. Maybe repeated without limit.

**ABRD 5215. International Study: Guatemala. (20 Hours)**

Offers an opportunity to study in Guatemala. Maybe repeated without limit.

### **Study Abroad - Business (ABRB)**

**ABRB 5100. International Study—Argentina. (20 Hours)**

Offers an opportunity to study in Argentina. May be repeated without limit.

**ABRB 5101. International Study—Canada. (20 Hours)**

Offers an opportunity to study in Canada. May be repeated without limit.

**ABRB 5102. International Study—France. (20 Hours)**

Offers an opportunity to study in France. May be repeated without limit.

**ABRB 5103. International Study—Germany. (20 Hours)**

Offers an opportunity to study in Germany. May be repeated without limit.

**ABRB 5104. International Study—Ireland. (20 Hours)**

Offers an opportunity to study in Ireland. May be repeated without limit.

**ABRB 5105. International Study—Netherlands. (20 Hours)**

Offers an opportunity to study in the Netherlands. May be repeated without limit.

**ABRB 5106. International Study—Singapore. (20 Hours)**

Offers an opportunity to study in Singapore. May be repeated without limit.

**ABRB 5107. International Study—Spain. (20 Hours)**

Offers an opportunity to study in Spain. May be repeated without limit.

**ABRB 5108. International Study—Chile. (20 Hours)**

Offers an opportunity to study in Chile. May be repeated without limit.

**ABRB 5109. International Study—Mexico. (20 Hours)**

Offers an opportunity to study in Mexico. May be repeated without limit.

**ABRB 5110. International Study—China. (20 Hours)**

Offers an opportunity to study in China. May be repeated without limit.

**ABRB 5111. International Study—Italy. (20 Hours)**

Offers an opportunity to study in Italy. May be repeated without limit.

**ABRB 5112. International Study—Hong Kong. (20 Hours)**

Offers an opportunity to study in Hong Kong. May be repeated without limit.

**ABRB 5113. International Study—Greece. (20 Hours)**

Offers an opportunity to study in Greece. May be repeated without limit.

**ABRB 5114. International Study—England. (20 Hours)**

Offers an opportunity to study in England. May be repeated without limit.

**ABRB 5115. International Study—Costa Rica. (20 Hours)**

Offers an opportunity to study in Costa Rica. May be repeated without limit.

**ABRB 5116. International Study—Japan. (20 Hours)**

Offers an opportunity to study in Japan. May be repeated without limit.

**ABRB 5117. International Study—Brazil. (20 Hours)**

Offers an opportunity to study in Brazil. May be repeated without limit.

**Study Abroad - CPS Specialty (ABRC)****ABRC 5001. International Study: Australia. (0 Hours)**

Offers an opportunity to study in Australia.

**ABRC 5002. International Study: Belgium. (0 Hours)**

Offers an opportunity to study in Belgium.

**ABRC 5003. International Study: Egypt. (0 Hours)**

Offers an opportunity to study in Egypt.

**ABRC 5004. International Study: Israel. (0 Hours)**

Offers an opportunity to study in Israel.

**ABRC 5005. International Study: England. (0 Hours)**

Offers an opportunity to study in England.

**ABRC 5006. International Study: Ireland. (0 Hours)**

Offers an opportunity to study in Ireland.

**ABRC 5007. International Study: Northern Ireland. (0 Hours)**

Offers an opportunity to study in Northern Ireland.

**ABRC 5008. International Study: Ghana. (0 Hours)**

Offers an opportunity to study in Ghana.

**ABRC 5009. International Study: Spain. (0 Hours)**

Offers an opportunity to study in Spain.

**ABRC 5010. International Study: Canada. (0 Hours)**

Offers an opportunity to study in Canada.

**ABRC 5011. International Study: Mexico. (0 Hours)**

Offers an opportunity to study in Mexico.

**ABRC 5012. International Study: Czech Republic. (0 Hours)**

Offers an opportunity to study in the Czech Republic.

**ABRC 5013. International Study: Italy. (0 Hours)**

Offers an opportunity to study in Italy.

**ABRC 5014. International Study: South Africa. (0 Hours)**

Offers an opportunity to study in South Africa.

**ABRC 5015. International Study: Sea Education Association. (0 Hours)**

Offers an opportunity to study under the auspices of the Sea Education Association.

**ABRC 5016. International Study: Singapore. (0 Hours)**

Offers an opportunity to study in Singapore.

**ABRC 5017. International Study: France. (0 Hours)**

Offers an opportunity to study in France.

**ABRC 5018. International Study: New Zealand. (0 Hours)**

Offers an opportunity to study in New Zealand.

**ABRC 5019. International Study: Vietnam. (0 Hours)**

Offers an opportunity to study in Vietnam.

**ABRC 5040. International Study: Argentina. (0 Hours)**

Offers an opportunity to study in Argentina.

**ABRC 5041. International Study: Chile. (0 Hours)**

Offers an opportunity to study in Chile.

**ABRC 5042. International Study: China. (0 Hours)**

Offers an opportunity to study in China.

**ABRC 5043. International Study: Costa Rica. (0 Hours)**

Offers an opportunity to study in Costa Rica.

**ABRC 5044. International Study: Middle East. (0 Hours)**

Offers an opportunity to study in the Middle East.

**ABRC 5045. International Study: Japan. (0 Hours)**

Offers an opportunity to study in Japan.

**ABRC 5046. International Study: Scotland. (0 Hours)**

Offers an opportunity to study in Scotland.

**ABRC 5047. International Study: Greece. (0 Hours)**

Offers an opportunity to study in Greece.

**ABRC 5048. International Study: Dominican Republic. (0 Hours)**

Offers an opportunity to study in the Dominican Republic.

**ABRC 5050. International Study: Denmark. (0 Hours)**

Offers an opportunity to study in Denmark.

**ABRC 5051. International Study: Turkey. (0 Hours)**

Offers an opportunity to study in Turkey.

**ABRC 5052. International Study: Sweden. (0 Hours)**

Offers an opportunity to study in Sweden.

**ABRC 5053. International Study: Germany. (0 Hours)**

Offers an opportunity to study in Germany.

**ABRC 5054. International Study: Portugal. (0 Hours)**

Offers an opportunity to study in Portugal.

**Study Abroad - Law (ABRL)****ABRL 5100. International Study—Argentina. (0 Hours)**

Offers an opportunity to study in Argentina. May be repeated without limit.

**ABRL 5101. International Study—Chile. (0 Hours)**

Offers an opportunity to study in Chile. May be repeated without limit.

**ABRL 5102. International Study—Italy. (0 Hours)**

Offers an opportunity to study in Italy. May be repeated without limit.

**ABRL 5103. International Study—Mexico. (0 Hours)**

Offers an opportunity to study in Mexico. May be repeated without limit.

**ABRL 5104. International Study—Costa Rica. (0 Hours)**

Offers an opportunity to study in Costa Rica. May be repeated without limit.

**ABRL 5105. International Study—China. (0 Hours)**

Offers an opportunity to study in China. May be repeated without limit.

**ABRL 5106. International Study—Turkey. (0 Hours)**

Offers an opportunity to study in Turkey. May be repeated without limit.

**ABRL 5107. International Study—England. (0 Hours)**

Offers an opportunity to study in England. May be repeated without limit.

**ABRL 5108. International Study—France. (0 Hours)**

Offers an opportunity to study in France. May be repeated without limit.

**ABRL 5109. International Study—School of Law. (0 Hours)**

Offers an opportunity to study off-campus with the School of Law. May be repeated without limit.

**ABRL 5110. International Study—Colombia. (0 Hours)**

Offers an opportunity to study in Colombia. May be repeated without limit.

**ABRL 5111. International Study—Brazil. (0 Hours)**

Offers students an opportunity to study in Brazil. May be repeated without limit.

**ABRL 5112. International Study—South Africa. (0 Hours)**

Offers students an opportunity to study in South Africa. May be repeated without limit.

**ABRL 5113. International Study—Spain. (0 Hours)**

Offers students an opportunity to study in Spain. May be repeated without limit.

**Study Abroad - Science (ABRS)**

**ABRS 5120. International Study—Three Seas Program. (20 Hours)**

Offers an opportunity to study in the Three Seas Program. May be repeated without limit.

## Study Abroad - Social Sciences and Humanities (ABRH)

### ABRH 5001. International Study—University of Amsterdam. (20 Hours)

Offers students an opportunity to study at the University of Amsterdam. May be repeated without limit.

### ABRH 6000. Study Abroad. (1-12 Hours)

Offers students an opportunity to study abroad at a partner university. May be repeated up to 11 times for up to 12 total credits.

## Study USA (ABRU)

### ABRU 5100. Study in the United States of America. (20 Hours)

Offers an opportunity to study at an off-campus location in the United States of America. May be repeated without limit.

## Supply Chain Management (SCHM)

### SCHM 1990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### SCHM 2301. Supply Chain and Operations Management. (4 Hours)

Focuses on the integrative management of business activities intrinsic to the smooth flow of goods or services, information, and financial transactions across firms from raw materials to the end customer. This collaborative approach creates competitive advantages for all members of a supply chain. Emphasizes the responsibilities of managers regarding decisions concerning the design, operation, and control of supply chains and operations. Considers customers, globalization, corporate strategy, resources, sustainability, ethics, and diversity. Topics covered include customer-centric management; supply chain and operations strategies; process structure and control; and supply, inventory, and quality management. Emphasizes the key role of information technology, logistics network design, supply chain relationships, and process evolution.

### SCHM 2990. Elective. (1-4 Hours)

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

### SCHM 3301. Global Supply Chain Strategy. (4 Hours)

Focuses on the managerial activities of those involved in supply chain management operations and planning for companies doing international commerce. Analyzes contemporary issues that affect the design of international supply chain systems, including sourcing, logistics, transactions, risk, sustainability, and ethical considerations. Examines the current status and future prospects of the modes of international transportation as well as international trade and development issues, not only from the corporate perspective but also in terms of government policy.

**Prerequisite(s):** SCHM 2301 with a minimum grade of D- or IE 4525 with a minimum grade of D-

### SCHM 3302. Supply Chain Management for Engineers. (4 Hours)

Focuses on the qualitative frameworks, processes, and activities involved in the planning, transformation, and delivery of goods and services in a context uniquely geared to engineering students, who likely have already studied many of the key quantitative aspects of modern supply chain management. Offers students an opportunity to obtain foundational knowledge in key areas such as project management, supplier selection, legal aspects of supply chain management, supplier relational management, global sourcing, and logistics.

### SCHM 3303. Supply Chain Risk Management. (4 Hours)

Explores the critical realm of mitigating supply chain disruptions within the dynamic landscape of contemporary business. Examines the intricacies of global supply chains, emphasizing real-world scenarios and exploring proactive measures such as diversification, technology integration, and strategic partnerships. Discusses challenges ranging from geopolitical uncertainties to natural disasters. Analyzes risk identification, assessment, and response strategies. Offers students an opportunity to gain practical insights into crisis communication, scenario planning, and the implementation of robust risk mitigation frameworks.

**SCHM 3305. Sourcing, Procurement, and Negotiation. (4 Hours)**

Addresses the strategic and operational role of sourcing and procurement and its impact on the supply chain as it relates to the entire organization. The selection, contracting, development and monitoring/managing of the right supplier in the right location is more often a source of competitive advantage and a major contributor to a company's bottom line. The course focuses on a variety of aspects of this function—strategy development, organization, procedures, supplier selection, negotiations, buyer-supplier relationship management, quantity, quality, timeliness, and cost/price considerations for the purchase of goods and services.

**Prerequisite(s):** SCHM 2301 with a minimum grade of D- or IE 4525 with a minimum grade of D-

**SCHM 3308. Supply Chain Analytics and Emerging Technologies. (4 Hours)**

Examines state-of-the-art in analytics capabilities and how they drive supply chains, from marketing to sourcing. Examines how organizations use analytics to meet their strategic objectives, provide value to the business, and make decisions. Offers students an opportunity to develop strategic supply chain decision-making skills using the latest analytics capabilities as an enabler. Focuses heavily on industry best practices, including looking at some of the leading companies.

**Prerequisite(s):** SCHM 3301 with a minimum grade of D- or SCHM 3305 with a minimum grade of D- or SCHM 3310 with a minimum grade of D-

**SCHM 3310. Logistics and Transportation Management. (4 Hours)**

Examines the logistics and transportation operations, including the structure, challenges, and potential of the major modes of domestic transportation. Focuses on the interaction between logistics providers and shippers in the marketplace. Explores the major dynamics of the logistics marketplace and their impact on supply chain management. Seeks to provide students with a managerial perspective on controlling what is typically the most expensive component of supply chain management, transportation expenditures.

**Prerequisite(s):** SCHM 2301 with a minimum grade of D- or IE 4525 with a minimum grade of D-

**SCHM 3315. Managing Healthcare Operations and Supply Chain. (4 Hours)**

Focuses on concepts and topics related to the design and management of healthcare sector operations and supply chain. Offers students an opportunity to learn about practices and strategies for effective management of operations and supply chain in healthcare organizations, including management of inventory, operations processes, capacity, procurement, logistics, IT systems, and attendant relationships, as well as various optimization tools and techniques.

**SCHM 3320. Forecasting and Sales and Operations Planning. (4 Hours)**

Offers a practical introduction to demand (sales) planning and forecasting for business students. Focuses on the organizational processes in managing demand as well as generating a forecast, regression analysis, exponential smoothing, time-series analysis, judgmental forecasting methods, and evaluation of forecast quality. Uses real-life data and various software packages to illustrate basic concepts.

**Prerequisite(s):** SCHM 3301 with a minimum grade of D- or SCHM 3305 with a minimum grade of D- or SCHM 3310 with a minimum grade of D-

**Attribute(s):** NUpath Analyzing/Using Data

**SCHM 3330. Sustainable Supply Chain Management. (4 Hours)**

Focuses on how to create sustainable supply chains that profitably yield high-quality, safe products without supply interruption while creating a net benefit for the employees, community, and the environment. Studies how companies measure environmental performance and use the data to motivate associates, suppliers, customers, policymakers, and the public. Also addresses the impacts of global sustainability frameworks and measures.

**Prerequisite(s):** SCHM 3301 with a minimum grade of D- or SCHM 3305 with a minimum grade of D- or SCHM 3310 with a minimum grade of D-

**SCHM 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SCHM 4970. Junior/Senior Honors Project 1. (4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8 credit honors project. May be repeated without limit.

**SCHM 4983. Special Topics in Supply Chain Management. (4 Hours)**

Offers special topics in Supply Chain Management. May be repeated once.

**SCHM 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SCHM 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of faculty members of the department on a chosen topic. Course content depends on instructor. May be repeated up to four times for a maximum of 8 semester hours.

**SCHM 6201. Operations and Supply Chain Management. (3 Hours)**

Focuses on the integrative management of processes and activities involved in transformation and delivery of goods and services. Offers students an opportunity to obtain foundational knowledge on operations and supply chain management concepts, techniques, and functions. Topics covered include sourcing and procurement, manufacturing and service operations, process design and control, quality management, capacity planning, demand planning and forecasting, inventory management, transportation and distribution management, interfirm relationship management, and attendant information flows.

**SCHM 6211. Logistics and Transportation Management. (3 Hours)**

Examines the logistics and transportation operations, including the structure, challenges, and potential of the major modes of domestic transportation. Focuses on the interaction between logistics providers and shippers in the marketplace. Explores the major dynamics of the logistics marketplace and their impact on supply chain management. Offers students a managerial perspective on controlling what is typically the most expensive component of supply chain management, transportation expenditures.

**Prerequisite(s):** SCHM 6201 (may be taken concurrently) with a minimum grade of C- or SCHM 6208 (may be taken concurrently) with a minimum grade of C- or SCHM 6210 (may be taken concurrently) with a minimum grade of C- or SCHM 6200 with a minimum grade of C- or IE 7200 with a minimum grade of C- or SCHM 6318 with a minimum grade of C-

**SCHM 6213. Global Supply Chain Strategy. (3 Hours)**

Focuses on the managerial activities of those involved in supply chain management operations and planning for companies involved in international commerce. Analyzes contemporary issues that affect the design of international supply chain systems and strategies, including sourcing, logistics, transactions, risk, and ethical considerations. Examines the current status and future prospects of the modes of international logistics operations as well as international trade and development issues, not only from the corporate perspective but also in terms of government policy.

**Prerequisite(s):** SCHM 6201 (may be taken concurrently) with a minimum grade of C- or SCHM 6208 (may be taken concurrently) with a minimum grade of C- or SCHM 6210 (may be taken concurrently) with a minimum grade of C- or SCHM 6200 with a minimum grade of C- or IE 7200 with a minimum grade of C- or SCHM 6318 with a minimum grade of C-

**SCHM 6214. Sourcing and Procurement. (3 Hours)**

Addresses the strategic and operational role of sourcing and procurement and its impact on the supply chain as it relates to the entire organization. The selection, contracting, development, and monitoring/managing of the right supplier in the right location is more often a source of competitive advantage and a major contributor to a company's bottom line. Focuses on a variety of aspects of this function—strategy development, organization, procedures, supplier selection, negotiations, buyer-supplier relationship management, quantity, quality, timeliness, and cost/price considerations for the purchase of goods and services. Emphasizes the perspective of the sourcing and procurement manager. The key questions addressed in this course are: What does the manager need to know to be effective? How do they apply key concepts?

**Prerequisite(s):** SCHM 6201 (may be taken concurrently) with a minimum grade of C- or SCHM 6208 (may be taken concurrently) with a minimum grade of C- or SCHM 6210 (may be taken concurrently) with a minimum grade of C- or SCHM 6200 with a minimum grade of C- or IE 7200 with a minimum grade of C- or SCHM 6318 with a minimum grade of C-

**SCHM 6215. Supply Chain Analytics. (3 Hours)**

Designed to develop strategic decision-making skills using the latest analytics capabilities and enabler. Examines the state of the art in analytics capabilities and how these drive supply chains, from marketing to sourcing. Also examines how organizations use analytics to meet their strategic objectives, provide value to the business, and make decisions. Focuses on industry best practices, including studying some of the leading companies.

**Prerequisite(s):** IE 7200 with a minimum grade of C- or SCHM 6200 with a minimum grade of C- or SCHM 6201 (may be taken concurrently) with a minimum grade of C- or SCHM 6208 (may be taken concurrently) with a minimum grade of C- or SCHM 6210 (may be taken concurrently) with a minimum grade of C- or SCHM 6318 with a minimum grade of C-

**SCHM 6221. Sustainability and Supply Chain Management. (3 Hours)**

Focuses on how to create sustainable supply chains that profitably yield high-quality, safe products without supply interruption while creating a net benefit for the employees, community, and the environment. Studies how companies measure environmental performance and use the data to motivate associates, suppliers, customers, policy makers, and the public. Also addresses the impacts of global sustainability frameworks and measures.

**Prerequisite(s):** SCHM 6201 (may be taken concurrently) with a minimum grade of C- or SCHM 6208 (may be taken concurrently) with a minimum grade of C- or SCHM 6210 (may be taken concurrently) with a minimum grade of C- or SCHM 6200 with a minimum grade of C- or IE 7200 with a minimum grade of C- or SCHM 6318 with a minimum grade of C-

**SCHM 6223. Managing Healthcare Supply Chain Operations. (3 Hours)**

Examines concepts and topics related to the design and management of supply chain operations in the healthcare sector. Focuses on activities and functions such as inventory control, order fulfillment, logistics, procurement, managing processes, relationship management, and information technology systems. Introduces various tools and techniques that enhance effective supply chain operations in healthcare organizations.

**SCHM 6224. Demand Planning and Forecasting. (3 Hours)**

Offers a practical introduction to demand (sales) forecasting for business students. Focuses on the organizational processes in generating a forecast, regression analysis, exponential smoothing, time-series analysis, judgmental forecasting methods, and evaluation of forecast quality. Uses real-life data and various software packages to illustrate basic concepts.

**Prerequisite(s):** SCHM 6201 (may be taken concurrently) with a minimum grade of C- or SCHM 6208 (may be taken concurrently) with a minimum grade of C- or SCHM 6210 (may be taken concurrently) with a minimum grade of C- or SCHM 6200 with a minimum grade of C- or IE 7200 with a minimum grade of C- or SCHM 6318 with a minimum grade of C-

**SCHM 6318. Managing Operations and the Supply Chain. (2 Hours)**

Focuses on the integrative management of processes and activities involved in transformation and delivery of goods and services. Emphasizes foundational knowledge on supply chain and operations management concepts, techniques, and functions. Topics covered include sourcing and procurement, manufacturing and service operations, logistics management, process design and control, inventory management, interfirm relationship management, and attendant information flows.

**SCHM 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SCHM 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

**Sustainable Building Systems (SBSY)****SBSY 5100. Sustainable Design and Technologies in Construction. (4 Hours)**

Covers theory of sustainability and green building procedures; sustainable design and construction practices; use of appropriate materials and systems with low environmental impact for creating energy-efficient buildings; green construction practices, including reducing pollution, emissions, and construction waste; and U.S. Green Building Council's LEED rating system. May be helpful to students preparing for the LEED Green Associate examination.

**SBSY 5200. Sustainable Engineering Systems for Buildings. (4 Hours)**

Focuses on the design and construction of sustainable mechanical/electrical/plumbing (MEP) systems in buildings. Covers MEP documentation, plumbing water supply, HVAC systems, electrical power supply and distribution, lighting systems, low-voltage electrical systems, and estimating and planning for these specialty areas. Addresses sustainable design and construction practices for MEP, including minimization of energy consumption and carbon footprint. Requires one semester of building physics, environmental systems, or equivalent.

**SBSY 5250. Building Performance Simulation. (4 Hours)**

Studies principles of building performance simulations and the application of these tools to improve the design and operation of buildings. Covers the basic principles of simulation and uses a spectrum of available tools for early stage modeling, daylight estimation, analysis of comfort, and whole building validation. Introduces interpretation and validation of results and code-mandated protocols.

**Prerequisite(s):** SBSY 5200 with a minimum grade of C-

**SBSY 5300. Information Systems for Integrated Project Delivery. (4 Hours)**

Focuses on new software systems for increasing efficiency of project delivery and facilitating design and construction integration through the use of BIM (Building Information Modeling) and related technologies. Exposes students to various software systems, including hands-on cases of BIM use, 4D (construction drawings linked to schedule) modeling, and 5D models (4D + cost). Covers the impact of new technology on project delivery, including owner's perspective, advantages, and disadvantages. Also covers use and background of common industry systems to apply BIM concepts to construction projects.

**SBSY 5400. Sustainable Building Systems Seminar. (0 Hours)**

Features prominent speakers from the sustainable building design and construction industry to showcase new building technologies, tools, and projects and to discuss national and international trends in the industry. Offers students an opportunity to meet innovators and key players advancing the field of sustainable building systems. May be repeated without limit.

**SBSY 5500. Deep Energy Retrofitting for Commercial Buildings. (4 Hours)**

Explores deep energy retrofits of existing buildings to meet stringent energy performance targets and reduce greenhouse gas emissions. Covers analysis, planning, design, implementation, and evaluation of retrofit interventions using building audits, sensing, forensic analysis, surveys, cost estimating, and simulation. Integrates students' prior knowledge and experience in architectural engineering, building science, energy analysis, and economic decision-making.

**SBSY 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SBSY 7945. Master's Project. (4 Hours)**

Offers students an opportunity for individual participation in an advanced research project in an area of sustainable building systems engineering. Topic is determined by the student and their advisor. Students complete individual laboratory, literature, and/or computational investigation; analysis of results; and preparation of a definitive report.

**SBSY 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**SBSY 7990. Thesis. (4 Hours)**

Offers analytical and/or experimental research conducted by arrangement with and under the supervision of the department.

**Prerequisite(s):** SBSY 7945 with a minimum grade of C-

**SBSY 7996. Thesis Continuation - Half-Time. (0 Hours)**

Offers continued thesis work conducted under the supervision of a departmental faculty member.

**Sustainable Urban Environments (SUEN)****SUEN 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SUEN 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SUEN 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SUEN 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SUEN 6110. Graduate Studio 1: Sustainable Urban Sites. (6 Hours)**

Offers a studio-based graduate-level introduction to design and management of sustainable urban sites. Core topics include fundamental site analysis, formal organization, spatial definition, and site operations. Emphasizes the contextual, programmatic, performative, aesthetic, and experiential aspects of waterfront and brownfield revitalization, with a focus on urban and landscape ecology best management practices (BMPs). Key tools and media are introduced and practiced in increasingly complex applications, including basic drawing, modeling, and design software.

**SUEN 6120. Graduate Studio 2: Sustainable Urban Systems. (6 Hours)**

Offers a graduate-level studio following SUEN 6110 and introducing fundamental landscape planning, design, and strategic management of environmental infrastructures at the urban and regional scale. Core topics include the spatial and operational role in the built landscape of living systems—such as constructed wetlands, urban forests, urban wilds, and managed habitats—and their dynamic relationship to recreation, transit, food, housing, and industrial networks. Emphasizes the integration of constructed ecologies into the cultural landscape around issues of environmental justice. Continues the introduction of key tools and media from SUEN 6110, including advanced digital drawing, modeling, and design communication.

**Prerequisite(s):** SUEN 6110 with a minimum grade of C-

**SUEN 6210. Implementation and Visualization for Urban Environments 1. (4 Hours)**

Offers an intensive introduction to site analysis and manipulation of earthworks, water, and vegetation, with a focus on disturbance regimes within waterfront and brownfield zones. Core topics emphasize the ecological services promoted by the urban environment, including urban soil structure; contouring the urban surface; regional plant communities; and storm water, surge, and tidal flux management. Supports development of implementation skills by training in vector, raster, and 3D modeling software. Constitutes the first half of a two-part sequence and provides the foundation for SUEN 6220.

**SUEN 6220. Implementation and Visualization for Urban Environments 2. (4 Hours)**

Constitutes the second half of a two-part sequence and builds upon material in SUEN 6210. Core topics include an introduction to regional landscape ecology in urbanized watersheds. Focuses on landscape-scale systems and soft infrastructure. Introduces GIS and geo-design software as a lens to learn about and visualize change in regional environments. Offers students an opportunity to advance landscape analysis and visualization skills through further training in vector, raster, and 3D modeling software.

**Prerequisite(s):** SUEN 6210 with a minimum grade of C-

**SUEN 6310. Cities, Nature, and Design in Contemporary History and Theory. (4 Hours)**

Offers a lecture course presenting a historical overview of evolving cultural, environmental, and technological influences on societal attitudes toward the relationship of cities, nature, and design. Core topics include the emergence of critical theories, aesthetic philosophies, and design typologies in the modern era of industrialization and the subsequent impact of information, participation, and globalization trends on twenty-first-century-designed urban environments.

**SUEN 6340. Topics in Urban Environmental Design. (4 Hours)**

Offers a lecture- and discussion-based course focusing on research themes relevant to the MDes-SUEN graduate program curriculum. Topics are developed based upon instructor's research relative to particular urban, ecological, sociological, landscape architectural, or technical subjects. Exposes students to cutting-edge methods of research and practice in designed urban environments. May be repeated up to two times.

**SUEN 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**SUEN 6964. Co-op Work Experience. (0 Hours)**

Offers eligible students an opportunity for work experience. May be repeated up to two times.

**SUEN 7130. Master's Research Studio: Design and the Resilient City. (6 Hours)**

Offers an advanced graduate studio focusing on contemporary landscape and urbanism research strategies. Themes include ecological, economic, and social resiliency in urban environments. Offers students an opportunity to formulate original approaches to design research. Uses integrated analysis, visualization, and conceptualization skills to progress through group and individual exercises with a focus on design thinking for climate change, water rise, public health and security, and other issues of global relevance. Requires the formulation of a design thesis for resilient urban environments, presented and defended in written, oral, and digital formats, which provides the basis for development of individual design proposals in SUEN 7140. Requires permission of the Urban Landscape program for students without a BARCH, BLA, MARCH, MCP MLA, MRP, MUD, or equivalent. May be repeated once.

**SUEN 7140. Master's Research Studio: Master's Project. (6 Hours)**

Constitutes the second half of the Master's Research Studio sequence. Using the design thesis established in SUEN 7130, offers students an opportunity to formulate proposals for intervention into a specific urbanized environment. Individual projects progress with instructor guidance from schematic phasing through design development, with a focus on change management and vitalization of the ecologic, economic, social, and aesthetic facets of contemporary cities and regions. Requires individual presentation and defense of master's projects in written, oral, and digital formats. May be repeated once.

**Prerequisite(s):** SUEN 7130 with a minimum grade of C-

**SUEN 7230. Urban Ecologies and Technologies 1. (4 Hours)**

Offers a workshop-based course as the first in a two-part sequence. Lectures, in-class exercises, and site-based investigation use case-study methods to document ecotechnologies operating in the built environment, with a focus on design and implementation metrics, material life cycle management, funding models, and aesthetic and cultural aspects. Potential topics include green roofs, green walls, bioswales, pervious pavements, constructed wetlands, "complete streets" elements, geosensor networks, alternative waste management, water detention and energy generation methods, and living infrastructure for coastal environments.

**SUEN 7240. Urban Ecologies and Technologies 2. (4 Hours)**

Offers a community outreach course as the second in a two-part sequence and builds upon SUEN 7230. The core theme is development of innovative, market-based ecotechnology prototypes for the urban landscape that contribute to the environmental and cultural life of the city. With instructor guidance, offers students an opportunity to identify a potential ecotechnology project to design through engagement with community members, public, or institutional clients. The course outcome includes site documentation; a schematic design proposal produced by students working in groups; and, if appropriate in terms of time, budget, and scale, implementation.

**Prerequisite(s):** SUEN 7230 with a minimum grade of C-

**SUEN 7320. Pro-Seminar: Issues in Designed Urban Environments. (4 Hours)**

Offers an advanced graduate seminar examining the forces shaping designed urban environments in contemporary global culture. A diverse range of material from published design criticism to open source social media engagement provides basis for discussion and written and oral presentations. Course themes determined by the instructor parallel the studio sequence SUEN 7130 and SUEN 7140, although discussion topics are broadly presented to engage graduate students from any background. May be repeated up to three times.

**Technical Communications - CPS (TCC)****TCC 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**TCC 2200. Introduction to Technical Writing. (3 Hours)**

Presents the elements of technical writing: performing audience analysis, conducting content-focused research, planning and structuring content, and designing documents/media for targeted audiences. Applies the output of content development, the results of information-gathering techniques, and the structure of content to a variety of media such as printed and electronic documents, Web content, and instructional materials. Offers students an opportunity to practice organizing, designing, researching, authenticating, formatting, writing, and editing content used in a variety of technical documents/media and for a variety of technical/nontechnical audiences; to examine a variety of technical documentation/media types; and to describe objects, mechanisms, or processes.

**Attribute(s):** NUpath Writing Intensive

**TCC 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**TCC 3450. Writing for the Web. (3 Hours)**

Compares and contrasts how readers/viewers scan rather than read Web pages and why Web writing differs from traditional text/prose writing. Describes writing styles and how to structure information for the Web. Defines human factors and how they affect writing for the Web. Describes Web navigation and labeling, examines visualization concepts and theory, and presents the processes of evaluation and usability testing. This writing-intensive course offers students an opportunity both for hands-on laboratory-type experiences through planning, designing, building, and testing Web sites and for collaborative work with classmates.

**Prerequisite(s):** ENG 1107 with a minimum grade of D-

**Attribute(s):** NUpath Writing Intensive

**TCC 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**TCC 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**TCC 6480. Instructional Design for Technical Communicators. (4 Hours)**

Focuses on the concepts and overview of instructional design for technical writers. Offers students an opportunity to analyze, design, and develop relevant and useful content for an intended audience, with a particular focus on materials with technical content. Course goals include building a foundation and conceptual framework surrounding the instructional design process. Emphasizes instructional strategies and skills to facilitate adult learning. Additional topics include determining the needs of the learner, techniques for stimulating and sustaining learner motivation, developing learning materials, using multimedia, and how to reinforce learning.

**TCC 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**TCC 7983. Topics. (1-4 Hours)**

Covers special topics in technical communications. May be repeated without limit.

**TCC 7995. Project. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.

**Telecommunication Systems (TELE)**

**TELE 5330. Data Networking. (4 Hours)**

Provides the basics of data networking protocols and architectures. Topics include protocol architecture of the internet; application protocols such as FTP, SMTP and HTTP, web caching, DNS, CDNs, and P2P applications; use of TCP and UDP socket programming to develop network applications in Python; transport protocols, including TCP, UDP, and TCP congestion control; IP protocol, addressing, IPv4 and v6, NATs, ICMP, and tunnels; routing algorithms and OSPF; data link protocols, encoding, framing, error control, and PPP; switched LANs, ARP, Ethernet, and VLANs; wireless LANs and 802.11 protocols; and network security—encryption, message integrity, authentication protocols, key management, SSL/TLS, IPsec, and 802.11i.

**Corequisite(s):** TELE 5331

**TELE 5331. Lab for TELE 5330. (0 Hours)**

Addresses a range of networking components, including routers, switches, and Linux servers, and how they are configured to create a virtual environment. Covers the installation and configuration of networking concepts such as DNS, DHCP, and firewalls and the creation of virtual environments. Requires students, working in teams, to configure one or more components; the teams then must interconnect the components to form a small network. In the process of configuration and integration, students are exposed to troubleshooting at various protocol layers and have an opportunity to become familiarized with different operating systems and networking tools.

**Corequisite(s):** TELE 5330

**TELE 5340. Telecommunications Public Policy and Business Management. (4 Hours)**

Introduces students to business management issues, such as basic accounting, finance, marketing, and operations in the telecommunications field, and also topics such as the time value of money and decision making. Also includes issues of human relations, organizational behavior, and business strategy. Provides an understanding of the regulatory environment of the telecommunications industry. Topics include universal service, service quality tariffs, the Modified Final Judgment and Telecom Act of 1996, market restrictions and segmentation, the current competitive environment in the United States and internationally, interconnection including unbundling, collocation, economic issues, and global trends in market reform.

**TELE 5350. Telecom and Network Infrastructure. (4 Hours)**

Provides in-depth treatment of the wireline and wireless infrastructure of the network supporting all telecommunication, internet, and enterprise applications. Covers the basics of communications—source coding, baseband and broadband modulation and transmission, channel coding, spread-spectrum, multiuser radio communications, radio link analysis, and propagation. Also covers the wireline core network—digital and optical transmission, framing, network synchronization, asynchronous and synchronous multiplexing, cross connects, SONET/SDH, DWDM, OTN, protection switching, and network availability. Addresses wireline (DSL, digital cable, FTTx, PONs) and wireless access (cellular, Wi-Fi), frequency reuse, and handoff. Also addresses support of data transport (switched Ethernet, VLAN, IP, MPLS) and application networks (PSTN, mobile core, internet, IPTV, and virtual networks).

**Prerequisite(s):** TELE 5330 (may be taken concurrently) with a minimum grade of B- or TELE 5330 (may be taken concurrently) with a minimum grade of B-

**TELE 5360. Internet Protocols and Architecture. (4 Hours)**

Offers in-depth treatment of protocols used in the internet, wireless access, and enterprise networks. Topics include protocols for network layer QoS (including DiffServ, ECN, RSVP, MPLS); protocols for security, including both access control and network-level security (e.g., X.509, SSL/TLS, IPsec, IKE, EAP); protocols for interdomain routing (BGP); protocols to support multicast, broadcast, and streaming applications; protocols to support host mobility, large server deployments, content distribution, and enterprise networks (VLANs, etc); and protocols to support IPv6 (e.g., address assignment) and its interoperability with IPv4. Also covers network design architectures for cloud computing, data centers, content distribution, layer-2 networks, etc. Discusses general scaling issues for large networks.

**Prerequisite(s):** TELE 5330 with a minimum grade of B- or TELE 5330 with a minimum grade of B-

**TELE 5600. Linux/UNIX Systems Management for Network Engineers. (4 Hours)**

Introduces UNIX/Linux in a networking/Internet environment. Covers operating system concepts, tools, and utilities; networking and security issues; and data and text processing using scripts and filters. Addresses basic administrative tasks such as managing users, file systems, security, and software. Covers networking topics such as network configuration, daemon processes, SSH, DNS, DHCP, diagnostic tools, and the use of scripts and automation to manage applications and systems, as well as security topics such as name and authentication services, access control lists, file modification protections, and firewalls.

**TELE 5976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**TELE 6100. Mobile Wireless Communications and Networking. (4 Hours)**

Studies communications and networking issues in providing broadband wireless access to mobile applications. Discusses networking technologies required by converged IP-based applications. Covers converged network architectures and the interworking of different generations of access technologies with the Evolved Packet Core (EPC). Registration limited and by application only; it is expected that all students have prior knowledge of digital communications, radio propagation, cellular networks, and second-generation wireless standards.

**Prerequisite(s):** TELE 5330 with a minimum grade of B- or TELE 5330 with a minimum grade of B-

**TELE 6300. Communication and Network Security. (4 Hours)**

Studies the skills necessary to apply and implement network and communication security in enterprise environments. Covers various concepts related to computer security and network protection. Explores systems security, access control, network infrastructure, assessments and audits, cryptography, and organizational security, all of which help to protect enterprise networks' confidentiality, integrity, and availability. Covers common network attacks, cryptography basics, computer forensics, and operational/organizational security related to physical security, disaster recovery, and business continuity. Discusses recent trends in network security attacks and cyberattacks, analyzing worms and trojans, SSL/TLS session renegotiations/compression, DNS security, spam, and crypto-based countermeasures.

**TELE 6350. Unified Communications and Collaboration. (4 Hours)**

Explores the technologies that underlie unified communications and collaboration (UCC) applications and communications networks. With the migration of communications infrastructure to the cloud, a democratization of communications is underway that allows customers to build powerful UCC applications on top of networks managed by service providers. UCC applications integrate audio and video conferencing, messaging, virtual whiteboards, and enhanced call control capabilities. Major topics include architecture of communication networks, IP-based voice, video and messaging protocols, public cloud-based communications, browser-based communications, and Communications Platforms-as-a-Service (CPaaS). Uses class projects to offer students an opportunity to get hands-on experience in addressing real-world problems in UCC communications infrastructure, services, and applications.

**Prerequisite(s):** TELE 5330 with a minimum grade of B- ; TELE 5600 with a minimum grade of B-

**TELE 6400. Software-Defined Networking. (4 Hours)**

Introduces the foundational theories and technologies of software-defined networking (SDN), a new paradigm in computer networking that allows a logically centralized software program to control the behavior of an entire physical network. Discusses SDN technologies, such as the OpenFlow specification and OpenDaylight controller, and introduces students to SDN applications and network function virtualization (NFV). Offers hands-on exposure to popular open-source software and technologies through student projects. Requires good knowledge of Java or Python.

**Prerequisite(s):** TELE 5330 with a minimum grade of B- or TELE 5330 with a minimum grade of B-

**TELE 6420. Infrastructure Automation Design and Tools. (4 Hours)**

Exposes students to best practices for infrastructure automation, which is highly critical in the design and deployment of network and server infrastructure that supports microservices architecture applications on public cloud (IaaS) services. Provides hands-on experience with IaC (infrastructure as code) technologies for provisioning and deprovisioning, configuration, patching, security, monitoring, alerting, logging, etc., for infrastructure components ranging from network devices to servers to entire virtual data centers. Focuses on both individual and team projects involving the use of IaC tools such as Ansible, Puppet, Git, Selenium, Netmiko, Paramiko, CFEngine, Docker, and Kubernetes for infrastructure deployment and automation.

**Prerequisite(s):** TELE 5330 with a minimum grade of B- or TELE 5330 with a minimum grade of B-

**TELE 6500. Machine Learning for IoT Systems. (4 Hours)**

Studies the design, development, rollout, and maintenance of machine learning algorithms for IoT systems, which generate and process time series data under memory and timeliness constraints. Focuses on verticals like Industry 4.0, wearables, and smart grids/homes. Explores the nuances of handling IoT time series data in both edge and cloud computing settings including the preparation, exploration, and feature engineering for sensor data. Covers domain-specific problem classes like forecasting, change point detection, and temporal anomaly detection. Addresses customized performance metrics for time series algorithms. Analyzes deep learning architectures for time series problems using TinyML for embedded devices. Course projects focus on time series, going beyond traditional datasets used in conventional ML classes.

**TELE 6510. Fundamentals of the Internet of Things. (4 Hours)**

Explores the foundations of and technologies involved in the Internet of Things (IoT). Topics include machine-to-machine (M2M) communications and its relationship with IoT. Examines fundamental components of the IoT architecture reviewing industry standards. Presents a large array of case studies. Discusses the fundamentals of data networks with a focus on different wireless technologies relevant to IoT, including the latest developments in IEEE 802.11, IEEE 802.15.4, and BLE, as well as network layer protocols such as 6LoWPAN that are critical to the deployment of wireless IoT networks. Discusses a range of IoT application protocols, especially MQTT, CoAP, and AMQP. Also explores IoT security and privacy considerations and identification mechanisms for IoT devices. Introduces wireless sensor networks and routing protocols for wireless networks.

**TELE 6530. Connected Devices. (4 Hours)**

Offers an in-depth, software-intensive exploration of the Internet of Things (IoT)—from device to cloud—culminating in a semester-long project where each student designs, builds, and presents an end-to-end, integrated IoT solution. Covers IoT concepts and architectures, and incorporates significant software development activities through weekly modules. Includes testing, DevOps, and messaging protocols specific to the IoT; device integration; and cloud services designed for IoT ecosystems.

**TELE 6550. IoT Embedded System Design. (4 Hours)**

Explores the technologies and techniques behind the field of design and development of modern embedded devices in IoT systems. Specifically, focuses on a hands-on approach to software development on an embedded hardware platform. Through a final project, students have an opportunity to build and deploy an industrial-grade state-of-the-art embedded IoT solution. Presents C coding, but also reviews the ARM ISA as well as C++ development and debugging. Applies theoretical concepts to practical issues including pipelining, parallelism, concurrency, memory architectures, and I/O (GPIO, I2C, UART, SPI). Introduces bare-metal and OS-based development focusing on multitasking, scheduling, interrupts, threads, processes, tasks, IPC, drivers, contention resolution, and shared memory. Introduces state-of-the-art Google Cloud IoT and FreeRTOS APIs.

**TELE 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**TELE 6973. Special Topics—Networking. (1-4 Hours)**

Offers topics of current interest in Networking. May be repeated seven times for a maximum of 8 total semester hours.

**TELE 7374. Special Topics in the Internet of Things. (4 Hours)**

Offers topics of current interest in the Internet of Things. Topics vary from semester to semester. May be repeated without limit.

**TELE 7945. Master's Project. (4 Hours)**

Supports a project in cyber-physical systems and the Internet of Things that may have both hardware and software elements. Project to be carried out under faculty supervision.

**TELE 7976. Directed Study. (1-4 Hours)**

Offers theoretical or experimental work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated up to seven times for a maximum of 8 semester hours.

**TELE 7986. Research. (0 Hours)**

Offers students an opportunity to conduct full-time research under faculty supervision.

**TELE 7990. Thesis. (4 Hours)**

Offers students an opportunity to conduct theoretical and experimental work under the supervision of a departmental faculty.

**Prerequisite(s):** TELE 7945 with a minimum grade of C-

**Technology Leadership (TELR)****TELR 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**TELR 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**TELR 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**TELR 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**TELR 5121. Technology Leadership 1. (2 Hours)**

Covers elements of technology practices such as technology engineering (system design and engineering, integration, and documentation); technology leadership (team building, communication, leadership styles, ethical behavior, and conflict resolution); market assessment (economics, business plans, intellectual property, risk assessment, and mitigation); and technology excellence (quality, reliability, serviceability, manufacturability, procurement, and problem solving). Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological depth and fostering the student's leadership development.

**TELR 5122. Technology Leadership 2. (2 Hours)**

Continues the examination of technology practices begun in TELR 5121. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological depth and fostering the student's leadership development.

**Prerequisite(s):** TELR 5121 with a minimum grade of B

**TELR 5131. Scientific Foundations of Technology 1. (2 Hours)**

Presents a review of the fundamental science underlying technology disciplines. Develops a conceptual framework to understand interdisciplinary engineering practice and to make informed, back-of-the-envelope, quantitative estimates. Provides a review of topics such as principles of mechanics and mechanics of materials, wave physics, quantum physics, statistical and thermal physics, fluid physics, Maxwell's equations and constitutive relations, and topics in chemistry and biology.

**TELR 5132. Scientific Foundations of Technology 2. (2 Hours)**

Continues the examination of fundamental science begun in TELR 5131.

**Prerequisite(s):** TELR 5131 with a minimum grade of B

**TELR 6962. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**TELR 7440. Technology Leadership Challenge Project 1. (4 Hours)**

Offers students an opportunity to develop and present a plan for the demonstration of a marketable technology product or prototype. This course is the first half of a thesis-scale project in technology commercialization. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological depth and fostering the student's leadership development.

**TELR 7442. Technology Leadership Challenge Project 2. (4 Hours)**

Continues TELR 7440, a thesis-scale project in technology commercialization. Offers students an opportunity to demonstrate their development of a marketable technology product or prototype and to produce a written documentary report on the project to the satisfaction of an advising committee. Requires work/training with a sponsoring organization or employer to improve a process or develop a project that is of significant value to the organization and demonstrates a quantifiable market impact while enhancing the student's technological depth and fostering the student's leadership development.

**Prerequisite(s):** TELR 7440 with a minimum grade of B

## Theatre (THTR)

**THTR 1000. Theatre at Northeastern. (1 Hour)**

Introduces new students to the communities and procedures of Northeastern University; the College of Arts, Media and Design; and the Department of Theatre. Offers insights into the study of the liberal arts in general and the creative facets of theatre study, including the rehearsal and production process. Emphasizes the departmental values of generosity, respect, and rigor and seeks to familiarize students with the arts and culture of Greater Boston.

**THTR 1100. Production Experience 1. (1 Hour)**

Offers lab practice in technical production. May be repeated once.

**THTR 1101. Introduction to Theatre. (4 Hours)**

Reveals the dynamic world of theatre by exploring the artistry, ideas, and techniques of actors, designers, directors, and playwrights. Goes behind the scenes in the study of theory and literature with both in-depth discussions and in-class performances. Includes a survey of significant movements in theatre history and analysis of diverse plays from contemporary drama. No theatre experience required.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**THTR 1120. Acting 1. (4 Hours)**

Focuses on the development of fundamental performance techniques and various significant acting methodologies needed by an actor to develop stage presence, strengthen the imagination, and increase freedom of expression. Studies, analyzes, and interprets contemporary texts through the performance of monologues and scenes.

**Attribute(s):** NUpath Creative Express/Innov

**THTR 1125. Improvisation. (4 Hours)**

Introduces theatre improvisation principles through games, exercises, and readings. Offers a playful and rigorous environment for students to respond to unexpected situations with confidence and agility. In this experiential studio course, students participate in group and individual exercises that explore and practice creative impulses, adaptability, risk taking, intuition, and teamwork. Culminates in a self-reflection paper.

**Attribute(s):** NUpath Creative Express/Innov

**THTR 1130. Introduction to Acting. (4 Hours)**

Introduces techniques that awaken the creative mind, body, and spirit of the actor. Through theatre games and voice/movement exercises, offers students an opportunity to explore and develop skills used by actors in preparation for a role. Students rehearse and perform scenes from contemporary plays. Designed for nontheatre majors; previous stage experience welcome but not required.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**THTR 1131. Introduction to Technical Theatre. (4 Hours)**

Surveys the technical and stagecraft skills that are essential knowledge for all theatre professionals. Offers students an opportunity to develop a hands-on understanding of the areas of scenery and costume construction, stage management, props, and lighting. Covers the practical skills needed to participate in the creation, evaluation, and revision of a theatrical production. Coursework includes laboratory-based classes in the department scene shop and costume shop.

**Attribute(s):** NUpath Creative Express/Innov

**THTR 1150. Dance Performance and History: Modern to Hip Hop. (4 Hours)**

Explores dance as both performance and history, practice, and theory. Examines the ways in which diverse dance genres—such as modern, jazz, American ballet, African-American, and hip-hop—embody ideas about culture, politics, race, and gender. Offers students an opportunity to rehearse and perform dance techniques of various styles and by significant choreographers. Includes research and writing assignments.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**THTR 1180. Dynamic Presence: Theatre Training for Effective Interpersonal Interactions. (4 Hours)**

Offers students across disciplines an opportunity to enhance the quality of their spoken voice and improve clarity of expression. Emphasizes being a dynamic presenter across digital platforms. Focuses on physical and vocal exercises drawn from theatre training and practice, providing tools to release tensions that inhibit the clear communication of thoughts and ideas in professional and interpersonal interactions across in-person and digital modalities. Students apply these skills directly to various texts, circumstances, and settings through active participation in spoken, written, and performative work.

**Attribute(s):** NUpath Creative Express/Innov

**THTR 1215. Activism and Performance. (4 Hours)**

Explores the intersection of theatre, politics, and social transformation by studying and experiencing the work of activist theatre artists in both traditional and nontraditional forms, such as docudrama, ritual, dance, street theatre, and community-generated performance. Examines the texts, theories, and practices of international theatre artists committed to ethical reasoning, social change, peace building, human rights, and community empowerment. Culminates in the creation of an original activist performance.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Interpreting Culture

**THTR 1220. Race, Power, and Performance. (4 Hours)**

Examines race, power, and privilege in global and national contexts by analyzing plays and theatrical performances as spaces of cultural representation. Analyzes performance as a communicative process for understanding and constituting identity. Students explore how they perform their own lives and racial identities and apply those theories to contemporary drama and performance texts that are read, watched, and created.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**THTR 1230. The Evolution of Fashion and Costume. (4 Hours)**

Traces the evolution of fashion and costume as a global cultural phenomenon. Focuses on the history and meaning of clothing design and the development of style using a non-chronological approach. Fashion does not occur only in Western capitals; it has existed for centuries in every region of the world. Clothing has been used to protect our bodies, establish relationships with others, indicate our status, and express our identities. Through readings, discussions, research, writings, and presentations, offers an opportunity to discover the extraordinary power of fashion and clothing.

**Attribute(s):** NUpath Interpreting Culture

**THTR 1233. Nineteenth- and Twentieth-Century Fashion in Europe. (4 Hours)**

Traces the evolution of fashion and costume in Europe from the beginning of the nineteenth century to the twenty-first century. Illustrated lectures focus on the history and meaning of clothing design and the development of style. Examines trends in fashion for men and women within its historical, cultural, political, and economic contexts. By studying fashion history in cities such as London and Paris, students have access to primary sources of fashion history, including paintings, sculpture, and textiles and garments from the periods being studied. Emphasizes current trends in fashion, with in-depth studies of the work of designers such as Dior, Chanel, McQueen, Westwood, Dolce & Gabbana, Versace, McCartney, and more. Taught abroad.

**THTR 1235. Fashion and Costume Design in Film and Television. (4 Hours)**

Examines the role of costume and fashion design in media, from the movies of the Golden Age of Hollywood to the latest high-tech motion pictures to the most recent cable miniseries. Studies the history and social contexts of clothing in media, as well as the critical role of fashion in relation to the narrative, i.e., how it enhances the mood and propels the dramatic action of the production. Uses illustrated lectures, critical thinking and writing, and a major experiential component to focus on how/why clothing is worn, how fashion design and costume design intersect, and how we can understand the economic and cultural realities of the twentieth and twenty-first centuries through the shifting trends of fashion.

**Attribute(s):** NUpath Interpreting Culture

**THTR 1236. Introduction to Global Fashion Studies: History, Theory, and Contemporary Practice. (4 Hours)**

Offers students an overview of the most significant and relevant theories on fashion, focusing on the cultural significance of clothing and style. Examines the intersection of fashion and other areas of study including the arts, history, economics, business, sociology, and anthropology. Explores global issues of gender, race, class, identity, image, style, material culture, and sustainability. Examines how populations from several postindustrial nations think about fashion, how globalization impacts their cultures and identities, and how designers and trendsetters are emerging from the new capitals of fashion.

**THTR 1237. Introduction to Global Fashion Studies Abroad: History, Theory, and Contemporary Practice. (4 Hours)**

Covers the most significant and relevant theories on fashion and focuses on the cultural significance of clothing and style. Examines the intersection of fashion and other areas of study including the arts, history, economics, business, sociology, and anthropology. Explores global issues of gender, race, class, identity, image, style, material culture, and sustainability. Examines how populations from several postindustrial nations think about fashion, how globalization impacts their cultures and identities, and how designers and trendsetters are emerging from the new capitals of fashion. Taught abroad.

**THTR 1240. Fashion Industry and Trend Forecasting in Europe. (4 Hours)**

Examines the world of global fashion forecasting with industry professionals in European cities such as London and Paris. Studies how and why global fashion trends are designed, developed, and produced and how economic and cultural realities are revealed through the shifting trends of fashion. Recent developments in business, politics, economics, and culture all have a tremendous impact on trends in fashion. Examines the fashion industry in terms of the five basic pillars of the complex fashion system: cultures of design, production, representation, consumption, and disposal. The course includes illustrated lectures, site visits to couture fashion houses/studios, an experiential component (the global fashion trend presentation), and the development of a class blog dedicated to trends seen by the students on the streets of Europe. Taught abroad. May be repeated without limit.

**Attribute(s):** NUpath Interpreting Culture

**THTR 1270. Introduction to Theatrical Design. (4 Hours)**

Introduces the principles of contemporary theatrical design and how to apply the creative process to scenery, costumes, and lighting. Offers students an opportunity to discover how design concepts are developed and relate to each other through research, script analysis, color theory, and visual composition. Seeks to develop the student's capacity for collaboration and techniques for conceptualizing a play into a multidisciplinary work of art. No theatre experience required.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**THTR 1400. Documentary Theatre Project. (4 Hours)**

Creates original theater from interviews conducted with individuals who have something to say about an issue relevant to their lives. It is of and for the community. Starts with acquainting students with the history of the project's theme and then determines, through theater games and acting exercises, an acting vernacular to use during rehearsals. From there, guides students in the collection of video interviews of the subjects. Students transcribe, edit, and collate the interviews into a script to be used for rehearsal. The second half of the semester is devoted to rehearsing and performing the script for a community presentation.

**THTR 1500. Musical Theatre Performance. (4 Hours)**

Develops an ensemble-based musical theatre showcase. Studies character development, movement and staging, acting, "acting a song" technique, and theatre terminology. Offers students an opportunity to work as directors and choreographers. Solo singing and prior experience are welcome but not required. Sessions consist of lectures; discussions; viewings; and, most importantly, studio work.

**Attribute(s):** NUpath Creative Express/Innov

**THTR 1600. Movement: Embodied Approaches to Creativity. (4 Hours)**

Emphasizes awareness of the body as an essential part of the actor's training. Focuses on individual and group training to strengthen and free the body, enliven the imagination, and maximize onstage physical presence. Explores various methods of established movement training techniques. Students synthesize what they learn from those explorations to create their own movement performance pieces.

**THTR 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**THTR 2000. Production Experience 2. (1 Hour)**

Offers lab practice in rehearsal and performance for production. May be repeated once.

**THTR 2200. The American Black Theatre Experience. (4 Hours)**

Introduces students to the art of Black theatre and cultivates an appreciation of the local Black theatre scene. Black theatre in the United States has a 200-year history that is important to understand for insight into contemporary Black theatre in the Boston area. Traces the growth of Black theatre from minstrel shows to James Brown's "King Shotaway" in 1823, to William Wells Brown's "The Escape" in 1858, to contemporary performances. Surveys the historical influence of the Harlem Renaissance, World War II, the Ethiopian Art Theatre, the Federal Theatre Project, the Civil Rights Movement, and the Black Arts Repertory Theatre to situate August Wilson, Suzan-Lori Parks, and George Wolfe as heirs to this rich heritage. Includes attendance at local theatre productions.

**Attribute(s):** NUpath Difference/Diversity

**THTR 2242. Fashion Retailing. (4 Hours)**

Introduces fashion retailing. Analyzes the different types and sizes of fashion retail operations; physical site location, including omnichannel; store layout and design; advertising and display; relation of the store to its intended target market; and store organization.

**THTR 2310. History of Musical Theatre. (4 Hours)**

Traces the creative evolution of the stage musical from its 19th-century origins to current Broadway hits; from popular entertainment to an important theatrical art. Offers students an opportunity to examine this unique and original art form from multiple perspectives—historical, cultural, political, and aesthetic—and to develop insights into the concepts and methods of such pioneering composers, lyricists, and theatre artists as Gilbert and Sullivan, Cole Porter, Rodgers and Hammerstein, Leonard Bernstein, and Stephen Sondheim.

**Attribute(s):** NUpath Interpreting Culture

**THTR 2330. Playwriting. (4 Hours)**

Offers a collaborative workshop environment for developing dialogue, scenes, and one-act plays. Analyzes the dramatic techniques of modern masters as well as acclaimed contemporary playwrights. Culminates in the development of original one-act plays and a presentation of workshop scripts by professional actors.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**THTR 2335. Boston Theatre Experience. (4 Hours)**

Offers a comprehensive experiential survey of professional theatre today. Students attend Boston-area productions that reflect a diverse range of styles and aesthetics, with special emphasis on the creation of new plays. Through preparatory readings and lectures, combined with postplay critical assessments (oral and in writing) and interactions with theatre artists (playwrights, actors, directors), offers students an opportunity to examine and discover how to interpret the art of contemporary theatre in the United States, from fringe companies to Broadway, as audience members and aspiring artists. Requires attendance at plays outside of class time.

**Attribute(s):** NUpath Interpreting Culture

**THTR 2340. Theatre and Society. (4 Hours)**

Covers several great practitioners of theatre. Focuses on how social behavior influenced the thought and craft of playwrights, actors, directors, designers, and theorists as well as how society was influenced by drama and theatre. Emphasizes how the play's ideas are translated into performance. Uses video, discussion, and live performance, when possible, as integral elements to the course.

**Attribute(s):** NUpath Interpreting Culture, NUpath Societies/Institutions

**THTR 2342. Acting 2. (4 Hours)**

Continues THTR 1120. Focuses on developing the actor's sense of truth and emotional freedom. Emphasizes creating, developing, and sustaining character and developing ensemble. Includes monologues and scenes performed for classroom analysis.

**Prerequisite(s):** THTR 1120 with a minimum grade of D-

**THTR 2345. Acting for the Camera. (4 Hours)**

Explores the craft and methods used by actors while working in front of the camera through monologues, scenes, and group projects. Provides students with techniques to identify and free their performance energy with a foundation on relaxation and authenticity. Includes the study and analysis of acting styles in diverse genres of film and television from situation comedies to dramas. Offers students an opportunity to explore a range of on-camera skills and acting techniques and apply them in filmed final projects. Previous acting experience suggested but not required.

**THTR 2346. Viewpoints. (4 Hours)**

Engages actors with an innovative technique that draws upon rigorous physical training exercises and practice in the nine areas of actors' concentration known as Viewpoints. Creative improvisational sessions provide an intuitive and dynamic approach to acting. Culminates in the application of Viewpoints to new scripted works.

**Prerequisite(s):** THTR 1120 with a minimum grade of D- or THTR 1130 with a minimum grade of D-

**THTR 2370. Lighting Design. (4 Hours)**

Examines basic principles and practices of stage lighting, including the qualities and functions of light, lighting instruments and controls, use of color and directionality, and script analysis for lighting design elements. Offers students an opportunity to develop foundational skills and practice systematic reasoning in the programming and operation of lighting computer equipment. Through group projects and individual lab work, students create and execute lighting designs. Includes work on electrics crews for university productions.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Formal/Quant Reasoning

**THTR 2380. Costume Design. (4 Hours)**

Introduces the fundamentals of costume design and the artistic roles and responsibilities of a costume designer. Working on classical and contemporary texts, students examine the creative steps of the design process, including script analysis, character development, research, and collaboration. Through lectures, discussions, and projects, students create a design concept and communicate it through language and images. Includes experience with drawing and other costume rendering techniques such as painting, collage, and Photoshop. Does not require prior art or design experience.

**Attribute(s):** NUpath Creative Express/Innov

**THTR 2385. Fashion Construction and Pattern Making. (4 Hours)**

Offers students an opportunity to develop the skills and techniques necessary for creating and using basic master patterns and dress forms to create skirts, dresses, trousers, and tops. Covers basic fashion construction, flat patterning, draping, and finishing techniques.

**THTR 2400. Scenic Design. (4 Hours)**

Introduces the theory and practice of theatrical design and the role of the designer in the production process. Through project work, examines the use of graphics tools—line, form, balance, color, rhythm, and so on—in the development of the design idea. Emphasizes understanding and utilizing spatial relationships; visually expressing conceptual themes; and understanding the various uses, problems, and practical considerations of proscenium, thrust, and arena staging.

**Prerequisite(s):** THTR 1270 with a minimum grade of D-

**Attribute(s):** NUpath Creative Express/Innov

**THTR 2500. Breaking the Glass Ceiling: Women in Theatre. (4 Hours)**

Surveys a wide range of dramatic forms, gender theories, and distinct theatrical techniques used by women artists to reveal larger social issues and encourage activism. Examines how the plays' sociocultural contexts represent female playwrights' diverse views of identity as well as their cultural, ethnic, racial, and geographical experiences. Identifies how women as artistic leaders are perceived and received by society and the industry. Analyzes why the issue of gender equity in theatre remains unresolved. THTR 2500 and WMNS 2501 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**THTR 2600. Voice and Speech Training. (4 Hours)**

Offers students an opportunity to develop the skills to enhance the quality of the spoken voice—the clarity and vitality with which actors express themselves on the stage. Follows the pedagogy known as "Freeing the Natural Voice," developed by Kristin Linklater. Includes learning and applying the International Phonetic Alphabet as a tool to clarify speech sounds.

**Prerequisite(s):** THTR 1120 with a minimum grade of C ; THTR 2342 with a minimum grade of C

**THTR 2973. Topics in Fashion Design Studies. (4 Hours)**

Offers students an opportunity for early undergraduate-level examination of a subject of particular significance in the fashion industry. May be repeated up to four times.

**THTR 2983. Topics in Theatre History and Culture. (4 Hours)**

Offers opportunity for early undergraduate examination of a subject of particular significance in the history of theatre. May be repeated up to four times.

**THTR 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**THTR 2991. Research in Theatre. (1-4 Hours)**

Offers an opportunity to conduct introductory-level research or creative endeavors under faculty supervision.

**THTR 2993. Topics in Dance. (4 Hours)**

Offers early undergraduates an opportunity to examine a subject of particular significance in the art, culture, history, or practice of dance. May be repeated four times.

**THTR 3100. Creative Storytelling for Social Engagement. (4 Hours)**

Explores the immersive learning process of creating a contemporary living newspaper play by critically examining important social issues or questions; identifying, synthesizing, applying, and revising ideas; and engaging in team-building performative activities. Explores innovative ways to address civic engagement through a culminating workshop production of a treatment for the play.

**Attribute(s):** NUpath Creative Express/Innov

**THTR 3200. Queer Theatre and Performance. (4 Hours)**

Explores significant dramatic texts that have shaped and expressed the changing nature of LGBTQ identity. Readings, viewings, lectures, and discussion focus on noteworthy queer plays as literature, history, cultural documents, and performance as seen through the lens of contemporary queer theories and knowledge. Analyzing these texts for their relevance to society and our lives, students evaluate and explore a range of topics including sexual identity, gender identity, religious and political views on queerness, the evolution of LGBTQ culture and communities, drag performance, homophobia, assimilation, appropriation, and coming out. Students who do not meet course restrictions may seek permission of instructor. THTR 3200 and WMNS 3200 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity

**THTR 3325. Dramaturgical Inquiry. (4 Hours)**

Designed to develop the analytical skills needed to prepare a play for production. Seeks to help the actor, director, designer, playwright, or dramaturg to communicate what they learn through both artistic processes and discipline-specific writing conventions to make intellectual contributions to the field of theatre and performance studies. The creative practice research process develops the dramaturgical ability to mine a script with an enhanced understanding of its context. Offers students an opportunity to hone the writing skills that communicate research findings for multiple academic, professional, and public audiences.

**Prerequisite(s):** (ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C); INAM 2000 with a minimum grade of C

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**THTR 3350. Fashion Marketing and Merchandising in Europe. (4 Hours)**

Examines the fundamentals of fashion marketing and merchandising in the established fashion capital of the world, Paris. Explores how basic marketing principles govern the fashion industry. Analyzes and evaluates the role and function of day-to-day industry professionals working and succeeding in Paris through site visits; lectures with industry professionals; and visits to fashion shows, collections, and museums. Taught abroad.

**THTR 3400. Stage Combat. (4 Hours)**

Studies basic techniques of unarmed and armed combat and employs these techniques to choreograph exciting fight sequences that are safe for actor combatants to perform and in line with the storytelling of the play. Analyzes the value of specific targeting and strategies to control time and space in a way that maximizes onstage storytelling, as well as how actors can participate in their own safety and the safety of their scene partners. Makes connections to the work done in class with the overarching principles of acting and storytelling. Offers students an opportunity to design, develop, notate, and film their own fight scenes. May culminate in a public sharing.

**Attribute(s):** NUpath Creative Express/Innov

**THTR 3550. Directing for the Stage. (4 Hours)**

Focuses on purposes and techniques of theatrical direction related to script analysis, production style, pictorial composition, rhythmic evolution, and empathetic responses.

**Prerequisite(s):** THTR 1120 with a minimum grade of D- ; THTR 1270 with a minimum grade of D-

**THTR 3650. Performing Theory. (4 Hours)**

Investigates performance as a method of analysis by examining foundational critical and performance theories and their relationship to contemporary performance practices. Performance studies as a field defines "performance" broadly, encompassing a wide range of live and digital performances within the contexts of everyday life, interpersonal communication, performance art, music, games, and theatre. Also includes performance installations, interactive events, mixed-media storytelling, digital performance, procedurally authored performance, mainstream and avant-garde theatre, etc. Students use theoretically grounded methods of creating original performance projects as research. Open to students with established generative storytelling skills in any discipline.

**Attribute(s):** NUpath Creative Express/Innov

**THTR 3670. Mixed-Media Performance Lab. (4 Hours)**

Focuses on multimedia performance design. Involves lectures and projects in different disciplines, with more advanced options for students with significant prior experience. Culminates in an immersive prototype conceived by the class in collaboration with the instructor with emphasis on mixed media, multi-camera shooting, the creation of 3D sets, and green screen technology in a low-fi VFX environment. Students work in groups, focusing on the specific design discipline they are most experienced in, to create sections of the performance.

**THTR 3702. Rehearsal and Production. (1 Hour)**

Offers students an opportunity to develop the experimental skills associated with dramatic interpretation and theatrical production by working on Department of Theatre productions under the supervision of faculty and staff. Most students enrolled in this course engage in the practices associated with one of the following areas: acting, design, stage management, or production crew head. Fulfills the experiential education requirement for theatre majors. May be repeated three times.

**Attribute(s):** NUpath Integration Experience

**THTR 3973. Topics in Performance Studies. (4 Hours)**

Examines at an undergraduate level a specific facet of particular significance in the interdisciplinary field of performance studies, which studies how embodied, digital, and nonhuman performance operates within a wide variety of contexts, such as everyday life, public events, interpersonal communications, performance art, games, and theatrical events. May be repeated thrice.

**THTR 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**THTR 4345. Advanced Acting for the Camera. (4 Hours)**

Offers students an opportunity to explore how to become an actor-entrepreneur—a reflective, resourceful, and resilient professional who can express a well-defined type that is received by industry professionals as humanized and effective. Requires actors to continually reflect on the course material through individual written assignments and performances. Identifying and marketing an industry type prior to a showcase includes developing a deep understanding of acting for the camera methods, applying industry standards of professional readiness, and constructing a set of core beliefs that inform the actor's choices and marketing strategies. The final project, a showcase for industry professionals, serves as an opportunity for actors to demonstrate their mastery of course material.

**Prerequisite(s):** THTR 2345 with a minimum grade of C

**THTR 4702. Capstone: Creative Practice Research Project. (4 Hours)**

Offers students an opportunity to conduct creative practice research, which is comprised of two components: the research, preparation, and execution of a substantial position of responsibility for a departmental production or a special creative practice project, under the supervision of a faculty member. Students write a capstone thesis paper, developing an original argument on a focused topic adjacent to their creative practice project. Students synthesize academic and experiential education through the paper, which requires research and analysis of focused evidence to make an original contribution to the current scholarly and/or professional conversation on their chosen topic.

**Attribute(s):** NUpath Capstone Experience, NUpath Writing Intensive

**THTR 4970. Junior/Senior Honors Project 1. (1-4 Hours)**

Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. May be repeated without limit.

**THTR 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**THTR 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**THTR 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**THTR 5300. Devised Theatre Project. (4 Hours)**

Investigates innovative and experimental methods of making an original theatre performance in which the actors are also the creators. Functions as a collaborative ensemble of actors that train, rehearse, and perform together. Explores performance theories and rehearsal techniques using language, movement, music, images, and autobiography to create a performative event inspired by a central theme drawn from literature, art, politics, or history. May culminate in a public performance. Requires prior completion of theatre training.

**Prerequisite(s):** THTR 1120 with a minimum grade of D- or THTR 1130 with a minimum grade of D- or THTR 2342 with a minimum grade of D- or graduate program admission

**THTR 5450. Acting 3. (4 Hours)**

Offers advanced acting training by exploring a variety of approaches useful in bringing the heightened dramatic texts alive on stage. Demands a free and efficient actor instrument: body, intellect, voice, and imagination simultaneously engaged and able to be compellingly present, and impeccable listening skills. Expects a significant amount of preparation, practice, and rehearsal outside the studio. Requires prior completion of basic acting training.

**Prerequisite(s):** THTR 2342 with a minimum grade of C or graduate program admission

**THTR 5700. Design for Immersive Performance. (4 Hours)**

Functions as an upper level design course focusing on designing space and media for theatre performance, with an emphasis on non-traditional and immersive formats. Involves lectures and projects in each discipline, with options for specific student interests. Culminates in an immersive performance conceived, designed, and created by the students. Students work in groups to create sections of the performance, focusing on the specific design discipline that interests them or for which they have experience.

**Attribute(s):** NUpath Creative Express/Innov

**THTR 5973. Topics in Fashion Design Studies. (4 Hours)**

Offers students an opportunity for upper-undergraduate and graduate-level in-depth examination of a subject of particular significance in the fashion industry. May be repeated up to four times.

**THTR 6100. Advanced Creative Storytelling for Social Engagement. (4 Hours)**

Examines the ways people use creative storytelling to forge human connection in digital environments. Includes theoretical readings and critical analysis of digital performances in social and historical context, alongside experiential projects in which students create digital performance projects and curate collections of digital performances for particular audiences and purposes. This creative practice research course is open to advanced students with established storytelling skills in any discipline.

**THTR 6650. Advanced Performing Theory. (4 Hours)**

Investigates performance as a method of analysis by examining foundational critical and performance theories and their relationship to contemporary performance practices. Performance studies as a field defines "performance" broadly, encompassing a wide range of live and digital performances within the contexts of everyday life, interpersonal communication, performance art, music, games, and theater. Also includes performance installations, interactive events, mixed-media storytelling, digital performance, procedurally authored performance, mainstream and avant-garde theatre, etc. Students use theoretically grounded methods of creating original performance projects as research. Open to students with established generative storytelling skills in any discipline.

**THTR 6670. Advanced Mixed Media Performance Lab. (4 Hours)**

Focuses on multi-media performance design. Involves lectures and creative practice research projects in different disciplines, with options for specific student interests. Includes research and analysis of focused evidence to make an original contribution to the current scholarly and/or professional conversation on their chosen topic. Culminates in an immersive prototype conceived by the class in collaboration with the instructor with emphasis on mixed media, multi-camera shooting, the creation of 3D sets, and green screen technology in a low-fi visual effects (VFX) environment. Students work in groups to create sections of the performance, focusing on the specific design discipline in which they are interested or for which they have experience.

**THTR 6973. Advanced Topics in Performance Studies. (4 Hours)**

Examines at a graduate level a specific facet of particular significance in the interdisciplinary field of performance studies. The field examines how embodied, digital, and nonhuman performance operates within a wide variety of contexts such as everyday life, public events, interpersonal communications, performance art, games, and theatrical events. May culminate in the creation of original performance projects. May be repeated up to two times.

## Women's, Gender, and Sexuality Studies (WMNS)

### WMNS 1101. Sex, Gender, and Popular Culture. (4 Hours)

Examines how femininities, masculinities, and different forms of sexual identity are produced and represented within popular culture. Using theories and concepts from both feminist/sexuality studies and popular culture studies, analyzes popular texts and media for their treatment of gender and sexuality and the intersection of those categories with racial and class identities. Explores the visual representation of women (and men) and analyzes how visual and textual media shape our attitudes and identities. Required reading and assignments include close readings of texts, film screenings, class discussions and activities, writing assignments, and creative projects.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

### WMNS 1103. Introduction to Women's, Gender, and Sexuality Studies. (4 Hours)

Offers an interdisciplinary course introducing key themes in gender and sexuality studies. Offers students an opportunity to learn core concepts that inform our understanding of how gender and sexuality are socially constructed and are experienced in everyday life. Drawing on women's studies, queer studies, masculinity studies, and allied areas, the course analyzes gender, sexuality, and other dimensions of identity; explores critical issues of gender, sex, and power; and studies gendered/sexed identities in both national and transnational contexts. Topics include the gendered conceptions of love, sexuality, and violence; biological arguments about gender and sexuality; the social construction of sexuality and gender; intersections of gender, race, class, and sexuality; masculinities and femininities; theories of sexual difference; gender and the state; and gender and popular culture.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

### WMNS 1104. Goddesses, Witches, Saints, and Sinners: Women and Religion. (4 Hours)

Introduces and examines the theory that Near Eastern and European religions were originally goddess centered through analyses of image, text, and ritual in the ancient world. Explores scholarship about the patriarchalization of these primal religions. Includes a consideration of scripture such as the Hebrew Bible, Greek Testament, and Qu'ran, as well as noncanonical texts.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

### WMNS 1105. Introduction to Trans Studies. (4 Hours)

Introduces students to the interdisciplinary field of transgender studies by focusing on the emergence of the field, key concepts, and pivotal debates.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

### WMNS 1225. Gender, Race, and Medicine. (4 Hours)

Examines the basic tenets of "scientific objectivity" and foundational scientific ideas about race, sex, and gender and what these have meant for marginalized groups in society, particularly when they seek medical care. Introduces feminist science theories and contemporary as well as historical examples to trace the evolution of "scientific truth" and its impact on the U.S. cultural landscape. Offers students the opportunity to question assumptions about science and view the scientific process as a site for critical analysis.

**Attribute(s):** NUpath Difference/Diversity

### WMNS 1255. Sociology of the Family. (4 Hours)

Provides a comparative approach to the study of families as social institutions, with particular emphasis on the changing patterns of family life. Introduces questions such as what families need and how the family is affected by other social institutions, political and economic forces, or cultural concerns. Considers how inequality (broadly defined) affects contemporary families. Substantive topics may include dating and marriage, cohabitation, health, and housing. Critically evaluates the methods that sociologists use to study changing practices of cohabitation, marriage, and divorce; interracial relationships; and changes in household composition, including same-sex or gender-nonconforming households.

**Attribute(s):** NUpath Societies/Institutions

### WMNS 1260. Sociology of Gender. (4 Hours)

Considers why and how gender is socially constructed in U.S. society and looks at different theories of gender. Explores gender as an institution as well as different (cultural) expressions of masculinities and femininities. Includes topics of gender in everyday life as well as gender as an organizing principle in the institutions of families, education, workplaces, sexualities, religion, the media, politics, and forms of gender violence. SOCL 1260 and WMNS 1260 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**WMNS 1271. Sex in Judaism, Christianity, and Islam. (4 Hours)**

Explores approaches to gender, social organization of sexuality and gender, sexual ethics, and marriage in Judaism, Christianity, and Islam. Explores various sources within each tradition that serve as normative foundations, contemporary cultural and sociological dynamics that challenge those foundations, and psychological/existential considerations for understanding the general nature of human sexuality. Addresses how these traditions understand gender and gender roles, seek to shape and control interactions between men and women, regulate sexual relations outside of and within marriage, view sexuality education, regard homosexuality, and examine historical and contemporary approaches to marriage, divorce, and parenting. PHIL 1271 and WMNS 1271 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Ethical Reasoning

**WMNS 1990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**WMNS 2259. Sex, Gender, and Judaism. (4 Hours)**

Introduces the representation of sex and gender in Jewish culture and religion. Explores varied representations of masculinity and femininity over time and place within Jewish communities; the role of biblical texts in the construction of Western conceptions of gender and sexuality; and how contemporary feminist, queer, and other sexual identities have influenced Jewish practices. Readings draw from a range of primary sources (memoirs, fiction, religious texts, etc.) and critical literature.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**WMNS 2302. Gender and Sexuality: A Cross-Cultural Perspective. (4 Hours)**

Explores concepts of "sex" and "gender" in a cross-cultural framework as they pertain to social status, work, the body, intersexuality, third or alternative genders, and intersectionality. Problematises normative assumptions about femininity and masculinity; the relations between men and women; and the meanings and implications of being a woman, man, or other-gendered person. Examines how social constructions of gender contribute and interact with other systems of categorization and structures of inequality such as race, class, and ethnicity.

**Prerequisite(s):** ANTH 1101 with a minimum grade of D- or SOCL 1101 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**WMNS 2303. Gender and Reproductive Justice. (4 Hours)**

Introduces the social, legal, and economic barriers to accessing reproductive healthcare domestically and internationally. Draws on various theoretical and analytic tools including critical race theory, critical legal theory, sociology of science, human rights, feminist theory, and a range of public health methods. Access to reproductive health services, including abortion, is one of the most contested political, social, cultural, and religious issues today. Covers domestic, regional, and international legal and regulatory frameworks on sexual reproductive health. HIST 2303, SOCL 2303, and WMNS 2303 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**WMNS 2304. Communication and Gender. (4 Hours)**

Presents a theoretical and practical examination of the ways in which communication is gendered in a variety of contexts. Integrates into this analysis how different institutions and interpersonal situations affect our understanding of gender roles. COMM 2304 and WMNS 2304 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**WMNS 2325. Black Feminist Studies. (4 Hours)**

Invites students to study the history and contemporary landscape of Black feminist scholarship. Covers a range of disciplines and historical periods to introduce students to important texts and theoretical developments in this vast and interdisciplinary field.

**Prerequisite(s):** ENGW 1102 (may be taken concurrently) with a minimum grade of C or ENGW 1111 (may be taken concurrently) with a minimum grade of C or ENGW 1113 (may be taken concurrently) with a minimum grade of C or ENGW 1114 (may be taken concurrently) with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**WMNS 2373. Gender and Sexuality in World History. (4 Hours)**

Introduces key concepts in the fields of gender and identity studies as they apply to world history since about 1800. Offers students an opportunity to understand the critical significance of gender, sex, sexuality, and identity to world events and how these contentious subjects influence the contemporary world. Surveys a series of major movements in geopolitics, labor, economics, culture, and society in order to analyze how individual and group identities, as well as mass assumptions about behavior and performance, have shaped these events. Gender, sex, and sexuality are integral to class discussions of work, welfare, art, culture, violence, war, and activism.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**WMNS 2451. Postcolonial Women Writers. (4 Hours)**

Examines the literature and cultures of postcolonial nations in the Caribbean, Africa, Asia, and elsewhere through the lens of gender. Designed to familiarize students with the relationships between cultural paradigms associated with gender and transnational experiences of colonialism. Focuses on the variety of artistic strategies employed by writers to communicate the impacts of gender and sexuality on contemporary postcolonial themes such as neocolonialism, nationalism, and diaspora. Writers may include Chimamanda Adichie, Nawal El Saadawi, Marjane Satrapi, Bessie Head, Arundhati Roy, Banana Yoshimoto, Sonia Singh, and Dionne Brand.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**WMNS 2455. American Women Writers. (4 Hours)**

Surveys the diversity of American women's writing to ask what it means to describe writers as disparate as Phillis Wheatley, Edith Wharton, Toni Morrison, and Alison Bechdel as part of the same "tradition." With attention to all genres of American women's writing, introduces issues of genre and gender; literary identification; canons; the politics of recuperation; silence and masquerade; gender and sexuality; intersectionality; sexual and literary politics, compulsory heterosexuality, and more.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**WMNS 2480. Women and World Politics. (4 Hours)**

Introduces a variety of issues facing women across the globe. Focuses on the gender dynamics of key issues in international affairs. These could include economic policy, conflict and war, human rights/women's rights, political power, and collective action. Draws on examples from various world regions since the twentieth century to analyze similarities and differences across cases around the globe. INTL 2480 and WMNS 2480 are cross-listed.

**Prerequisite(s):** INTL 1101 with a minimum grade of D-

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**WMNS 2501. Breaking the Glass Ceiling: Women in Theatre. (4 Hours)**

Surveys a wide range of dramatic forms, gender theories, and distinct theatrical techniques used by women artists to reveal larger social issues and encourage activism. Examines how the plays' sociocultural contexts represent female playwrights' diverse views of identity as well as their cultural, ethnic, racial, and geographical experiences. Identifies how women as artistic leaders are perceived and received by society and the industry. Analyzes why the issue of gender equity in theatre remains unresolved. THTR 2500 and WMNS 2501 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**WMNS 2505. Digital Feminisms. (4 Hours)**

Explores the unique ways that feminist activism and theory are impacted by the increasing digital nature of our world. From hashtags to Tumblr, feminists are using digital tools and platforms to aid in the pursuit of social justice. Offers students an opportunity to develop a timeline that traces feminists' engagement with the Internet, new media, and technological innovations from the late seventies to the present. Examines the strengths and challenges that the digital world creates for feminist engagement. MSCR 2505 and WMNS 2505 are cross-listed.

**Attribute(s):** NUpath Creative Express/Innov, NUpath Interpreting Culture

**WMNS 2800. Sexual Orientation and Gender Expression. (4 Hours)**

Introduces students to efforts among social and nonprofit organizations working to reduce heterosexism, homophobia, and transphobia in institutions, communities, and the society as a whole. Discusses practice across the life span for social professionals (social workers, counselors, advocates, and educators) in varied settings such as criminal justice, mental health, adoption, adult day health, and residential programs. Applying theories and current scholarship on LGBTQQ identity development, social movements, media, and advocacy, offers students an opportunity to evaluate contemporary issues of controversy for institutions, social practitioners, and policy. HUSV 2800 and WMNS 2800 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity

**WMNS 2850. Sexual Politics and the Practice of Sexuality Education. (4 Hours)**

Uses interdisciplinarity and theory-based approaches to study the interplay between sexual politics and the fields comprising human services. Considers contemporary and historical paradigms of sexual health as they both reflect and shape politics, social inequality, cultural ideologies, and individual health and wellness. Incorporates strategies from sociology, social work, public health, and the education fields—as well as theoretical foundations from feminist, gender, queer, inequality, and prevention studies—to inform examination of social change embedded in professional practice.

**Attribute(s):** NUpath Societies/Institutions

**WMNS 2990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**WMNS 2991. Research Practicum. (2-4 Hours)**

Involves students in collaborative research under the supervision of a faculty member. Offers students an opportunity to learn basic research methods in the discipline. Requires permission of instructor. May be repeated once for up to 4 total credits.

**WMNS 3100. Gender, Social Justice, and Transnational Activism. (4 Hours)**

Introduces key issues, themes, and debates in feminist transnational theory, practice, and activism in contemporary contexts and how it has changed under socioeconomic, political, and cultural processes of globalization. Examines differences among women relating to race, class, sexuality, national identity, and political economy in reckoning with possibilities for sustainable social justice. Students interrogate the relationship between the local and global; the production of knowledge in different regional spaces; the pragmatics of political mobilization; the varying contours of "social justice"; and other key issues. Offers students an opportunity to discuss the impact of globalization, neoliberalism, and state and intimate violence on gendered politics and relations and to contend with the politics of difference, to debate its challenges, and to imagine possible futures for transnational gender justice.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**WMNS 3110. Gender, Crime, and Justice. (4 Hours)**

Examines the topics of femininities and masculinities and their influence on participants in the criminal justice system. Also explores topics such as gender and criminological theory; the notion of gender and offending; women and men as victims of violence; and women and men as professionals within the criminal justice system.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**WMNS 3200. Queer Theatre and Performance. (4 Hours)**

Explores significant dramatic texts that have shaped and expressed the changing nature of LGBTQ identity. Readings, viewings, lectures, and discussion focus on noteworthy queer plays as literature, history, cultural documents, and performance as seen through the lens of contemporary queer theories and knowledge. Analyzing these texts for their relevance to society and our lives, students evaluate and explore a range of topics including sexual identity, gender identity, religious and political views on queerness, the evolution of LGBTQ culture and communities, drag performance, homophobia, assimilation, appropriation, and coming out. Students who do not meet course restrictions may seek permission of instructor. THTR 3200 and WMNS 3200 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity

**WMNS 3305. Beyond the Binary: Race, Sex, and Science. (4 Hours)**

Considers how gender, race, and sexuality have been treated in science, focusing primarily on the 19th and 20th centuries. Examines the history of ideas about gender, race, and sexuality as reflected in fields such as biology, psychology, endocrinology, and neuroscience. Discusses contraceptive and reproductive technologies, pharmaceutical trials, the gendering of scientific professions, and recent studies that use algorithmic predictions of sex or sexual orientation. Uses close reading techniques and discussions to advance student expertise.

**Attribute(s):** NUpath Difference/Diversity, NUpath Societies/Institutions

**WMNS 3392. Gender and Film. (4 Hours)**

Examines the representation of gender in film. Uses concepts and research from film and media studies to investigate the influences and consequences of gender representations in film. WMNS 3392 and MSCR 3392 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity

**WMNS 3500. Sexuality, Gender, and the Law. (4 Hours)**

Examines the legal regulation of gender and sexuality. Investigates concrete legal cases to study the history of constitutional interpretation and the current status of rights for women and sexual minorities. Focuses on important theoretical issues emerging in the writings of diverse feminist and queer legal scholars. Addresses debates over the value of conventional equality approaches in legal doctrine; equality vs. difference perspectives; ways in which legal language constructs gender and sexuality; the incorporation of sexuality and gender in ideologies of law; and the intersections of gender, sexuality, and race in legal doctrine and legal theory. PHIL 3500, POLS 3500, and WMNS 3500 are cross-listed.

**Attribute(s):** NUpath Ethical Reasoning, NUpath Societies/Institutions

**WMNS 3580. Sexual Violence: Counseling, Programs, and Policy. (4 Hours)**

Offers an in-depth examination of sexual violence, its effects, and the resources available to assist survivors. Presents an overview of the criminal justice, medical, legal, and counseling systems and the impact these interweaving systems have on survivors. Offers students an opportunity to develop crisis counseling competency through group exercises and experiential activities. HUSV 3580 and WMNS 3580 are cross-listed.

**WMNS 3678. Bedrooms and Battlefields: Hebrew Bible and the Origins of Sex, Gender, and Ethnicity. (4 Hours)**

Considers stories from Hebrew Scripture in English translation, beginning with the Garden of Eden through the Book of Ruth, asking how these foundational narratives establish the categories that have come to define our humanity. Analyzes how the Bible's patterns of representation construct sexual and ethnic identities and naturalize ideas about such social institutions as "the family." ENGL 3678, JWSS 3678, and WMNS 3678 are cross-listed.

**Prerequisite(s):** ENGL 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGW 1111 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C

**Attribute(s):** NUpath Interpreting Culture

**WMNS 3900. Gender and Black World Literatures. (4 Hours)**

Explores different aspects of the literary and cultural productions of black women throughout history. Examines writing by women in the United States—like Octavia Butler, Zora Neale Hurston, and Toni Morrison—in addition to writing by women across the global African diaspora—like Chimamanda Adichie and Jamaica Kincaid. Students may also engage with theories such as Black feminism, womanism, or intersectionality; consider issues of genre such as the novel, poetry, or science fiction; and explore key themes such as class, sexuality, and disability. AFRS 3900, WMNS 3900, and ENGL 3900 are cross-listed.

**Attribute(s):** NUpath Difference/Diversity, NUpath Interpreting Culture

**WMNS 3990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**WMNS 4520. Race, Class, and Gender. (4 Hours)**

Considers the intersection of race, class, and gender in social structure, institutions, and people's lives. Utilizes an interdisciplinary approach to focus on the socially constructed nature of these concepts and how they shape and create meaning in individual lives. Difference with an emphasis on inequality and varying life chances is central for understanding our society and is central to our work. Requires a significant amount of reading. Class format is like a seminar; students are expected to participate, take responsibility, and write a paper. SOCL 4520 and WMNS 4520 are cross-listed.

**Prerequisite(s):** (SOCL 1101 with a minimum grade of D- or ANTH 1101 with a minimum grade of D- or CRIM 1100 with a minimum grade of D- or HUSV 1101 with a minimum grade of D- or INTL 1101 with a minimum grade of D- or POLS 1140 with a minimum grade of D- or POLS 1160 with a minimum grade of D- or WMNS 1103 with a minimum grade of D- ); (ENGW 1111 with a minimum grade of C or ENGW 1102 with a minimum grade of C or ENGL 1111 with a minimum grade of C or ENGL 1102 with a minimum grade of C or ENGW 1113 with a minimum grade of C or ENGW 1114 with a minimum grade of C )

**Attribute(s):** NUpath Writing Intensive

**WMNS 4990. Elective. (1-4 Hours)**

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

**WMNS 4992. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**WMNS 4994. Internship. (4 Hours)**

Offers students an opportunity for internship work. May be repeated without limit.

**Attribute(s):** NUpath Integration Experience

**WMNS 5240. Feminist Resistance. (4 Hours)**

Engages students in the study of a variety of forms of feminist resistance in recent history, emphasizing the United States in the context of cross-cultural examples. Examines key feminist texts and manifestos and studies feminist activism in coalition with other social movements. Students identify and analyze unique features of gender-based activism in itself and in its intersections with other social movements, including movements and activism focused on race, class, sexuality, and physical ability.

**Attribute(s):** NUpath Societies/Institutions

**WMNS 6100. Theorizing Gender and Sexuality. (4 Hours)**

Seeks to challenge and expand our understanding of the relationship between biological sex; gendered identities; and sexual "preferences," practices, and life ways. This interdisciplinary course offers debates around sex, gender, sexuality, and the body that push beyond binary models reliant on a simple "nature/culture" distinction. Focuses on dynamic and variable aspects of sexuality, sex, and gender within and across cultures, representational forms, and historical periods, analyzing the circumstances in which they undergo significant challenge or transformation. Uses particular paradigmatic "case studies" to push hard at the boundaries of sex and gender and to dialogue around contesting conceptualizations of "the body," "sex," and "gender," particularly as they circulate in specific discourses of feminism, queer theory, and poststructuralism; ethnic studies; critical race theory; and cultural studies.

**WMNS 7100. Queer Theory: Sexualities, Genders, Politics. (4 Hours)**

Introduces the core texts and key debates that have shaped queer theory and examines the intersections between queer theory and feminism and critical race theory. Seeks to provide an understanding of expansive and radical contemporary queer politics by analyzing foundational queer and feminist texts, pushing beyond narrow constructions of identity politics, anti-discrimination policy, and rights-based reforms. Engages queer theory by means of a rich philosophical and political interrogation of the meaning and content of "queer." SOCL 7100 and WMNS 7100 are cross-listed.

**WMNS 7900. Special Topics in Women's, Gender, and Sexuality Studies. (4 Hours)**

Examines selected topics in women's, gender, and sexuality studies. May be repeated up to five times.

**WMNS 7976. Directed Study. (1-4 Hours)**

Offers independent work under the direction of members of the department on chosen topics. May be repeated without limit.

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