Physics and Physical Sciences

PHYS101 Introduction to Physical Sciences (3 units)
This is an introductory course to expose the students to physical science subjects including the basics of astronomy, chemistry, earth science, and physics.
(GE- in Sciences area)
Prerequisite: **Pre-calculus subjects**

PHYS201 Physics – I (3 units)
This course is designed to be the first of a series in physics for engineering students. Topics include vectors, motion and Newton's laws, gravitation, work and energy, momentum, mechanics of rigid bodies, oscillations, kinetic theory of gases, waves and sound, and thermodynamics. Laboratory practices are conducted formally each week.
Prerequisite: **MATH201**

PHYS201L Physics Lab – I (1 unit)
This course is designed to be taken with the course PHYS201 Physics - I. The student first learns to use the general measuring equipment, the proper experimental procedures, and lab safety issues. The student is expected to gain skills in data analysis and lab report writing throughout the trimester. Lab topics include measurements of position and velocity, kinematics, Newton's laws of motion, energy, momentum, conservation laws of energy and momentum, collisions, torque, rotational dynamics, waves, and thermodynamic behaviors.
Prerequisite: **MATH201**

PHYS202 Physics – II (3 units)
This course is the second of a series in physics for engineering students. Topics include Coulomb's law and electric fields, currents and DC circuits, magnetic fields, time-varying EM fields, AC circuits, optics, interference, diffraction, and an introduction to modern physics. Laboratory practices are conducted formally each week.
Prerequisite: **PHYS201**

PHYS202L Physics Lab – II (1 unit)
This course is designed to be taken with the course PHYS202 Physics - II. The student learns to use electrical measuring equipment to conduct the first several experiments related to electromagnetism. Lab safety as well as skills in data analysis and lab report writing are stressed. Lab topics include measurement of electric field and potential, simple circuits, resistors, DC circuits, Kirchhoff's laws, capacitors, RC circuits, magnetic effects, inductors, AC circuits, electromagnetic induction, RLC circuits, geometrical optics, lenses, and light as a wave.
Prerequisite: **PHYS201L**

Professional Development

P450 Career Development (1 unit)
This course is designed for the students to take in preparation for becoming working professionals. Topics include effective communication strategies, emotional intelligence, diversity and cultural awareness, professional behavior, and interview skills.

Social Science
(GE – in Social Sciences area)

SOC201 California History (3 units)
This course is designed to expose the students to the uniqueness of California history and its evolution. Topics include the social, economic, and political development of the "Golden State" over the last three centuries, spanning the Native-American, Spanish, Mexican, and American periods. Lectures, case studies, and field trips for research are the forms of study in this course.

PSY210 Introduction to Psychology (3 units)
This psychology course reflects on theories and concepts of behavior and processes of the mind. Students will be introduced to topics as motivation, emotion, personality, social behavior, perception, learning, and development. Different areas of psychology will be examined, such as cognitive, forensic, social, and developmental psychology. Additional topics may include environmental and biological factors affecting behavior, adaptation to stress and adversity, common disorders, experimental methods, current research trends, etc.

SOC215 Introduction to Sociology (3 units)

This course provides a study of culture, social organization, and social relations. Additional topics include the major social problems in society, with an emphasis on how those problems are interrelated and the role of society in their creation and perpetuation. Issues and problems related to cross culture and diversity will also be addressed.

SOC235 Multiculturalism in the United States (3 units)

This course looks into various aspects of multiculturalism in American society, exploring issues related to race, ethnicity, gender, sexual orientation, disability, and other social group identities.

SOC250 Public Administration (3 units)

This course serves as an introduction to public administration. Early key thinkers in the development of public administration will be examined. During the trimester, topics such as public policy formation, public management, human resources, reinvention, privatization, e-Government, public finance, performance measurement, and ethics will be reviewed. Students will become familiar with the primary issues and challenges facing public administrators today.

SOC260 Civilization and Urbanization (3 units)

This is an introductory course designed to cover the 5,000 year shift from rural to urban throughout the world. The city is civilization's greatest work of art but has many challenges. The ancient walled cities, utopian writings, urban theories, religious experiments, English Garden Cities and new towns, American Greenbelt Towns, company towns, flight to the suburbs, Neo-traditional planning, the New Urbanism, and current sustainable development, Smart Growth, to the more recent Greening and Healthy Cities will be described and the actual city and regional planning practices are shown.

SOC275 The American Experience (3 units)

This course is designed to lead the students to examine the 20th century rise of the United States as a modern multiethnic society with emphasis on the socioeconomic and political forces that have shaped its development.

HIST340 Modern American History (3units)

This course covers the development of the United States from post-Civil War (1865) to the present. Students will further develop their historical research, writing, critical thinking and presentation skills throughout this course. Covered topics start with the 1800's Reconstruction, Immigration, Industrialization, Western Expansion and American Urbanization, followed by the 20th century's World War I, The Great Depression, The New Deal, World War 2, Korean War, Baby Boom Generation, Vietnam War, Civil Rights Movement and Globalization. The course concludes with the 21st Century including the impact of September 11, 2001, Terrorism, and Modern Technology.

HIST400 Early American History (3 units)

This course is designed to lead the students to examine the early periods of American history that shaped the development of the nation, including America before Columbus, European expansion, the founding era and Revolution, the Constitution and the new republic, and subsequent periods of civic and political growth up to the Civil War.

Prerequisite: **ENGL101**

SOC450 Emotional Intelligence (3 units)

Emotional Intelligence (EI) or Emotional Quotient (EQ) defines the skills or capacity to recognize ones' own emotions and those of others and how to control these emotions. In this course, the students will learn about Emotional Intelligence (EQ) and how to manage interpersonal relations and why it's important in their life and career. They will learn how to increase their EQ in developing their abilities in perceiving, using, understanding and managing emotions. EQ is a type of intelligence that unlike IQ can be increased and the benefits of it is apparent in one's life and career. Knowing yourself is the essence of EQ. Students will learn about themselves by assessing their EQ in the beginning of the class and at the end of the term to see if any improvement took place. In recent years, EQ has become a major indicator of achievement. This course will provide the means to increase and manage your EQ.

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◙ Master's Degree Programs

The School of Engineering offers two master's degree programs:

- Master of Science in Computer Science (MSCS)

- Master of Science in Electrical Engineering (MSEE)

• Objective

The objective of the master's degree programs is to provide advanced engineering training to those who wish to practice their profession with increased competence in the high-technology electronics and computer industries. Each program emphasizes both mastery of subject matter and an understanding of related research and research methodology. This emphasis implies development of the student's ability to integrate and apply the subject matter.

• Committee Oversight

The responsibility for developing, modifying, and maintaining each master's degree program is performed by the Academic Committee for this School. The Academic Committee is led by a designated group of members who invite inputs from qualified students, faculty, administrators, employers, as well as the Advisory Committee members to conduct their duties.

• Credential Requirements

Master's degree program applicants must hold a valid bachelor's degree. Applicants must have been in good academic standing at the last institution attended. A bachelor's degree with a minimum CGPA of 2.5 is required. A bachelor's degree with a CGPA below 2.5 does not qualify for admission. However, if the applicant holds a graduate degree which demonstrates significant improvement in academic performance and yields a combined CGPA of 2.5 or above, this applicant may qualify for admission.

An applicant who holds (or is pursuing) a master's or doctoral degree must provide the transcripts for those degree programs. Academic achievements and CGPA earned from the applicant's graduate studies will also be used in the credential evaluation process.

• Distance Learning

The MSCS program is approved for distance learning. This allows students to mix and match on-site & online courses or choose to take 100% online courses. Online courses may be offered in a synchronous or an asynchronous modality.

• Application Requirements

Graduate program admission follows a holistic review process. Academic and non-academic achievements are considered while assessing an applicant's ability to succeed in the master's programs. An interview with the Academic team may also be conducted if necessary.

To apply for admission into a master's degree program, the applicant is required to submit the following to the SFBU Admissions Office:

1. Online Application Form
2. Nonrefundable application fee
3. Copy of passport or a government issued I.D.
4. Official transcripts from ALL previously attended institutions

5. Foreign Credential Evaluation: Foreign transcripts must be evaluated by a member of National Association of Credential Evaluation Services (NACES), Association of International Credential Evaluators (AICE), or American Association of Collegiate Registrars and Admissions Officers (AACRAO)'s International Education Services
6. A document certifying completion of a bachelor's degree; a transcript printed with degree completion information will suffice
7. An English proficiency document is required for non-native English speakers: An official transcript with English course records or TOEFL/IELTS/ iTEP/PTE Academic/ Cambridge B2 First score report or equivalent will suffice. See English Proficiency Requirement below for detailed information on the English entrance requirement.

Additional suggested indicators of potential success at SFBU. **Provide evidence of one or more of the following:**

- Additional undergraduate and/or graduate degrees and certifications
- Previous coursework or training in the intended field of study
- Work experience
- Achievement in sports, music and/or other creative pursuits
- Involvement in community/volunteer services
- Fluency in multiple foreign languages
- Personal statement with background and purpose for seeking the degree
- Other special skills

- **F-1 International Students**: In addition to the above general application requirements, an international applicant is required to submit the following additional documents:

1. A financial support document – provide a recent financial support document indicating a minimum amount of $39,800 available to pursue study in the first academic year at SFBU.
    - A current bank letter and bank statement; or
    - A loan letter from a lending institution; or
    - Copies of fixed deposits.

    An affidavit of support or sponsor letter is required if the funds are not in the applicant's name.
2. A transfer student (from a U.S. institution) is required to submit a photocopy of his/her
    - previous I-20 form,
    - visa, and
    - I-94 (U.S Department of Homeland Security issued arrival / departure form).

Applicants interested to apply for scholarships need to provide additional documents. Please refer to the section on Scholarships in this catalog and on the website.

• Credential Evaluation Requirement

Applicants who have earned their bachelor's credentials at a foreign institution must provide a course-by-course credential evaluation analysis. This credential evaluation must be completed by a member of National Association of Credential Evaluation Services (NACES), Association of International Credential Evaluators (AICE), or American Association of Collegiate Registrars and Admissions Officers (AACRAO)'s International Education Services. This credential evaluation must be in the original sealed envelope, if it is a hard copy; an electronic copy may be sent directly from the evaluation agency to SFBU.
Note: International schools/colleges accredited by U.S. regional accrediting bodies are exempt from this requirement.

- **English Proficiency Requirement**

Non-native English speakers are considered meeting the entrance English proficiency requirement if they meet any of the following requirements:

- An official IELTS (Academic), TOEFL (iBT), TOEFL Essentials, iTEP Academic, PTE Academic or Cambridge B2 First test score report. Minimum Score:
  - IELTS (Academic) 5.5 band
  - TOEFL (iBT) 59
  - TOEFL Essentials 6.5 band
  - iTEP Academic 3.7
  - PTE Academic and PTE Academic Online 50
  - Cambridge B2 First 168
- Successful completion of IEP Upper Intermediate Level B with a grade of B or better in all four courses
- An English assessment report from a few U.S. English language institutions recognized by major universities in the U.S.
- A degree earned or a college-level English credit course passed at an institution located in the U.S., U.K., Ireland, Australia, New Zealand, or Canada
- A degree earned at an institution in which the language of instruction is strictly English (as determined solely by SFBU)

- **Entrance Assessment Test**

GRE test score is optional. Applicants may submit GRE or other national level exam scores to strengthen their application.

SFBU's institution Code for reporting the GRE score is 5485.

- **General Background Preparation Requirements**

Each individual graduate program may require additional background preparation requirements before acceptance into the program. Background preparation requirements and information on how to clear those requirements are found under the graduate program sections of the Catalog.

- **Transfer of Credit from Other Institutions**

Graduate course credit earned at other accredited higher education institutions may be transferable to meet the student's graduation requirements if the courses are closely related to the engineering course requirements in the student's intended program of study and the grade earned meets the requirement stated below. Such course credits are considered qualified transfer credits. Credit transfer is made by the admission evaluators while conducting the admission evaluation.

The following statements apply to qualified transfer credits:

- The SFBU Admissions Office must receive all official transcripts prior to the student's joining a degree program. Without preapproval, transcripts received after the student joins SFBU cannot be used in transferring credits, except for records from the term immediately preceding the student's starting trimester at SFBU. Up to 12 units of courses that have been reviewed and currently approved as part of a formal SFBU articulation/transfer agreement are guaranteed to transfer.

- The student was officially enrolled in the course.

- Courses eligible for transfer will be evaluated based on the comparability in content, quality and rigor of SFBU's courses. The transfer evaluation will include, but is not limited to, course descriptions, course

syllabi, and/or general public information. Students may be asked to provide course catalogs or syllabi if needed. Up to 12 units of courses that have been reviewed and currently approved as part of a formal SFBU articulation/transfer agreement are guaranteed to transfer.

- No more than 12 units of qualified graduate-level course credits may be transferred. Students must take at least 24 units at SFBU degree program.
- Without prior approval, courses for transfer to SFBU may not be completed concurrently at another institution while a student is matriculated in an SFBU.

- The credits contemplated for transfer must be earned at (1) institutions approved by the Bureau for Private Postsecondary Education, (2) public or private institutions of higher learning accredited by an accrediting association recognized by the U. S. Department of Education, or (3) foreign institutions of higher learning. Credits earned at a foreign institution degree must be evaluated by a member of National Association of Credential Evaluation Services (NACES), Association of International Credential Evaluators (AICE), or American Association of Collegiate Registrars and Admissions Officers (AACRAO)'s International Education Services.

- Professional Development Units (PDUs) offered by professional/industry organizations cannot be transferred to SFBU for academic credit.
- Continuing Education Units (CEUs) offered on a non-academic basis by other academic institutions cannot be transferred to SFBU for academic credit.

- Credits transferred at the time of admission evaluation will reduce program length. Credit transferred from any outside institution has no effect on the calculation of the student's GPA or CGPA.

- Credits transferred from any outside institution are excluded from the maximum attempted units for the program.

- Credits are transferred by the following conversion:

  a. Definition of a Trimester Unit:
  One trimester credit hour equals, at a minimum, 15 contact classroom hours of lecture, 30 contact hours of laboratory, or 45 contact hours of practicum.

  b. Conversion Factor:
  1 quarter unit = **0.66** trimester unit

- **Grades Required for Transfer Credit**
  In the master's degree programs, qualified courses completed with an equivalency of a letter grade of "B" or better are transferable. Courses completed with Pass/No Pass are not transferable unless the transcript states that the general grading policy is not based on letter grades. This policy must be in writing from the institution (transcript key or a letter of verification).

- **Proficiency Exams:** A student may be required to **demonstrate proficiency in an undergraduate background subject taken more than ten years prior to application** with SFBU by successful completion of a **proficiency examination**.

  A student may also select to take proficiency exams **to clear the background preparation** required by the program. Rules for taking proficiency exams must be observed by the student. Of particular importance is timing for taking each proficiency exam. Clearance of a background subject must be completed early enough to meet two conditions: (1) There must be sufficient time for administrative processing of the exam and (2) Processing of the exam must be completed prior to the student's registration in any course with the background preparation subject as a prerequisite for the course.

❑ **Experiential Learning**

SFBU does not award credit for prior experiential learning.

• Tuition

Tuition is charged per unit. Tuition for courses taken to fulfill the master's degree requirement is $450.00 per unit.

- **Tuition per Unit for Courses Audited**

For courses audited (without earning credit), the tuition is half the regular unit rate. Not all courses can be taken with "audit" status.

- **Estimated Total Charges for On-time Completion of Entire Educational Program**

    - Tuition: $16,200
    - Fees: $1,600
    - Graduation Petition Fee: $300
    - Textbooks & Software Costs: $1,800
    - Health Insurance Premium: $1,980

    - **MSCS:** $21,880
    - **MSEE:** $21,880

Please note that this estimate includes tuition, fees, textbooks costs, and health insurance premium, which is subject to change. All students are required to pay current rates for tuition and fees each trimester. Additional fees may apply, depending on the services requested (see Tuition and Fee section). The cost of textbooks is estimated to be approximately $150 per course. The actual cost of textbooks can vary significantly from course to course.

• Graduation Requirements

A minimum of **36 units of graduate-level coursework** is required for each master's degree program.

The following conditions must also be met in order for a student to be eligible for graduation:

- Maintain a grade of C or better for all courses taken towards the degree requirements,
- Maintain an overall G.P.A. of 3.0 or better,
- Maintain good standing with the University – with clear financial, library, and other school records,
- The student is approved to graduate after filing a petition for graduation.

✦ Capstone Course

The capstone course in each engineering master's degree program is intended to integrate the knowledge and hands-on experience that the student has acquired from the coursework taken in the program. The capstone course instructor determines the course objectives and scope based on the degree curriculum and technology trend. With this learning experience, the student is prepared to pursue his/her career in the high-technology industry.

The student shall take the capstone course near the end of his/her program of study.

✦ Career Planning

Students are encouraged to gain real-world experience by engaging in curricular practicum training (internship) when applicable. For career planning, students meet one-on-one with the Career Center staff in their first term of enrollment. Students learn to prepare their resumes and participate in job searches and other activities. The students may utilize the online eCareer Center from their portal for job listing and off-campus job fairs.

The following are descriptions of the master's engineering degree programs, each with a statement of objectives, a description of the background preparation for the program, and the program curriculum.

Course Numbers: Courses numbered from 450G to 499G are cross-listed specialized courses taken for graduate-level credits; courses numbered in the 500s and above are graduate-level courses. Cross-listed specialized courses and graduate-level courses are taken to meet the graduation requirements.

• Master of Science in Computer Science (MSCS)

Program Objectives: The MSCS degree program is designed to provide advanced knowledge and hands-on experience in computer science to students who are interested in gaining expertise in software engineering as well as modern Internet technologies and applications. Through the learning process, the students not only acquire knowledge in modern computer technologies but also cultivate abilities in software design, development, deployment, and integration aspects of professional learning. They are encouraged to apply their knowledge and skills to course projects that match industry trends.

Program Learning Outcomes: Students graduating with an MSCS degree are expected to demonstrate the following program learning outcomes -

Written & Oral Communication - Effectively present the concepts, designs, and outcomes for software development projects in written and oral forms.

Quantitative Reasoning & Problem Solving - Employ current computer science technologies, methodologies, and quantitative analysis to examine modern industry challenges and formulate suitable solutions.

Information Literacy - Demonstrate the proficiency and resourcefulness in utilizing multiple sources of information to research, design, or implement complex programming projects.

Critical Thinking, Analysis & Creative Thinking - Apply critical thinking and problem-solving skills to analyze computing problems and derive at solutions based on evidences and practicality.

Specialized Knowledge, Integrative Learning & Creative Thinking - Practice specialized knowledge relevant to the area of expertise and the skills attained in the program study to complete required tasks in professional manners.

Background Preparation

Students admitted into the MSCS degree program are required to have a bachelor's degree (BS / BA / BE) in computer science/engineering or in another field with a sufficient background in computer science and mathematics, including course work and/or experience equivalent to (as deemed appropriate by the Academic team) all the following subjects:

1. Mathematics – Calculus, Linear Algebra, and Statistics/Probability
2. Introduction to Python Programming Language and Programming Logic
3. Data Structures

Additional documents and/or an interview may be requested by the Academic team to assess and validate the qualification of an applicant who did not complete an undergraduate degree in Computer Science/ Engineering.

A student who lacks any of the background preparation requirements listed above is expected to clear them by either (1) taking the course at SFBU or another approved institution/organization that is comparable in subject matter, quality, and rigor as SFBU and earning a grade of at least C or higher, or (2) taking and passing a proficiency exam on the subject. The student must clear background preparation requirements before acceptance to the MSCS program.

MSCS Curriculum

A minimum of **36 trimester units of graduate study** are required for the MSCS program. They include a few required foundation courses, a number of specialization courses based on the student's selection of technical pursuit, a required capstone course, and electives. The software engineering coursework is to develop technical skills beneficial to the student for career planning. The student also has the opportunity to take elective courses outside of computer science to broaden the student's skillset.

The student must meet prerequisite requirements before enrolling in any course. Upon clearing background preparation work, the student starts to take courses to meet the degree requirements. The student must begin his/her graduate study with the subjects listed in the Foundation Requirements section.

I. Foundation Requirements (11 units)

(Required subjects)

CS455G	Algorithms & Structured Programming or
CS501	Practical Application of Algorithms; and
CS457G	Data Modeling and Implementation Techniques
CS457LG	Database Technologies Lab
CS500	Object-Oriented Design in Python
CS500L	Object-Oriented Design in Python Lab

II. Specialization Requirements (12 units)

The student is advised to consider industry trends and career choices when selecting computer science courses. Before taking the Capstone Course near the end of the program, the student will have taken a minimum of 12 units of graduate level software engineering courses, (or those corresponding to one of the chosen concentrations below), and 10 units of electives.

Concentrations

The student may choose one of the three concentrations shown below and complete 12 units of the associated courses listed under the concentration. After completing these selected courses, the student will be able to request that the concentration area be specified on the transcript and the diploma to highlight the field of specialization.

Cybersecurity:

CS535	Network Security Fundamentals
CS571	Cloud Computing Infrastructure
CS581	Cloud Security
CS589	Special Topics (related to Cybersecurity)
CS477G	Ethical Hacking and Penetration Testing (taken as an Elective course)

Data Science:

CS550	Machine Learning and Business Intelligence
CS570	Big Data Processing & Analytics
CS589	Special Topics (related to Data Science)
CS481G	Introduction to Data Science (taken as an Elective course)

Network Engineering:

CS515	UNIX/Linux Network Programming
CS535	Network Security Fundamentals

CS565 Advanced Network Management
CS575 Network Analysis and Testing

The following are examples of cluster courses that the student may select to strengthen the knowledge and skills related to an area of interest without declaring a concentration for their MSCS degree:

Cloud Computing and Big Data:

CS550 Machine Learning and Business Intelligence
CS570 Big Data Processing & Analytics
CS571 Cloud Computing Infrastructure

Mobile Application Technologies:

CS548 Web Services Techniques and REST Technologies
CS551 Mobile Computing for Android Mobile Devices
CS556 Mobile Applications on iPhone Platform

QA Engineering:

CS521 Software Project Management
CS522 Software Quality Assurance and Test Automation
CS548 Web Services Techniques and REST Technologies
CS575 Network Analysis and Testing

Selecting any four (4) courses from the above lists will meet the Specialization Course Requirements. Taking four (4) courses in a cluster area will also help the student develop desirable skills that support the chosen area of interest and profession

Other CS5xx level courses offered by the School of Engineering may also be taken to complement the knowledge and skills desired. A cross disciplinary study of areas of interest can be desirable as the changing computer industry has become more demanding on engineers to have multidisciplinary skillsets.

III. **Electives** (10 units)

The student may take any graduate-level courses, including those outside of software engineering, to meet the electives requirement of 10 units. At least 6 of these units must comprise of courses with numbers at or higher than 500. When applicable, the student may take Curricular Practicum courses and engage in practical training to work on company projects that are directly related to the student's course of study. No more than 6 units of practicum coursework may be counted towards graduation.

IV. **Capstone Course** (3 units)

(A required subject)

Upon completing all or most coursework for this program, the student is required to take the capstone course and, under the guidance of the course instructor, integrate the knowledge and skills learned from all of the courses taken during the program.

CS595 Computer Science Capstone Course

• Master of Science in Electrical Engineering (MSEE)

Program Objectives: The MSEE degree program is designed to provide students with advanced knowledge and hands-on experience in electronics and embedded system engineering, with an emphasis on the Internet of Things (IoT). Through the learning process, the students not only acquire knowledge in modern electronics and embedded system technologies but also cultivate abilities in designing, simulating, and integrating the engineering subjects learned. They are encouraged to apply their knowledge and skills to course projects that match industry trends.

Program Learning Outcomes: Students graduating with an MSEE degree are expected to demonstrate the following program learning outcomes -

Written Communication & Critical Thinking - Create reports for engineering projects that demonstrate an advanced level of proficiency and evidence-based decision making ability.
Specialized Knowledge & Written/Oral Communication - Apply the specialized skills relevant to graduate level work to examine problems, synthesize the data/information, and communicate the requirements and the solutions effectively.
Quantitative Reasoning - Prepare engineering prototype models, conduct experiments, collect measurements, analyze the data, and effectively interpret the results.
Information Literacy - Demonstrate the expertise and resourcefulness in utilizing multiple sources of information to research and strategize solutions necessary to complete engineering projects.
Integrative Learning, Problem Solving & Creative Thinking - Produce robust hardware/software solutions to meet industry needs in the modern technology areas by utilizing existing technology in a novel manner.

Background Preparation

Students admitted into the MSEE degree program are required to have a bachelor's degree (BS / BA / BE) in electrical or in another field with a sufficient background in engineering, mathematics and science, including course work and/or experience equivalent to (as deemed appropriate by the Academic team) all the following subjects:

1. Mathematics: Calculus, Linear Algebra, and Statistics/Probability;
2. Sciences: Physics;
3. Electrical and Computer Engineering Subjects: C Programming, Python Programming, Circuit Theory, and Logic Design.

Additional documents and/or an interview may be requested by the Academic team to assess and validate the qualification of an applicant who did not complete an undergraduate degree in Electrical Engineering.

A student who lacks any of the background preparation requirements listed above is expected to clear them by either (1) taking the course at SFBU or another approved institution/organization that is comparable in subject matter, quality, and rigor as SFBU and earning a grade of at least C or higher, or (2) taking and passing a proficiency exam on the subject. The student must clear background preparation requirements before acceptance to the MSEE program.

MSEE Curriculum

A minimum of **36 trimester units of graduate study** are required for the MSEE program. They include a few required foundation courses, a number of engineering courses based on the student's selection of technical pursuit, a required capstone course, and electives. The engineering coursework in the ranges of electronics and computer engineering will develop technical skills beneficial to the student for career planning. The student also has the opportunity to take elective courses outside of the electronics or computer engineering areas to broaden the student's skillset.

The student must meet prerequisite requirements when taking any course. Upon clearing background preparation work, the student starts to take courses to meet the degree requirements. The student must begin his/her graduate study with the subjects listed in the Foundation Requirements section.

I. Foundation Requirements (11 units)

(Required subjects)

CE450G	Fundamentals of Embedded Engineering
CE450LG	Embedded Engineering Lab
EE461G	Digital Design and HDL
EE461LG	Digital Design and HDL Lab
EE488G	Computer Architecture

II. Engineering Course Requirements (12 units)

The student is advised to consider industry trends when selecting electronics and computer engineering courses. Before taking the Capstone Course near the end of the program, the student will take a minimum of 12 units of graduate level engineering courses and 10 units of electives. Choices of field of study include the following: Internet of Things (IoT), embedded systems, multi-core computing, and modern IC technologies.

The following are examples of cluster courses for each area of interest area:

Internet of Things (IoT) and Embedded Systems:

EE517	Introduction to the Internet of Things (IoT)
CE521	Real-time Systems and Programming
CE522	Embedded Design in Networking Environment
CE523	Embedded Design in Device Driver Environment
CE530	Embedded Software Design in Linux

Multi-core Computing:

EE504	Advanced Computer Architecture
EE553	System on Chip (SoC) Design

Modern IC Technologies:

EE505	Advanced Digital IC Design
EE511	Advanced Analog IC Design
EE520	Advanced FPGA Design and Implementations
EE577	Design Verification with System Verilog

Each trimester when the course offering list is published, instructions on graduate level courses belonging to various areas of interest are also published along with the course offering list. Every graduate student is advised to refer to these instructions to select courses and build his/her expertise area. In addition, a cross disciplinary study of engineering areas of interest can be desirable as the fast-changing electronics and computer industries have become more demanding on engineers to have multidisciplinary skillsets.

III. Electives (10 units)

The student may take any graduate-level courses, even outside of engineering, to meet the electives requirement of 10 units. When applicable, the student may take Curricular Practicum courses and engage in practical training to work on company projects that are directly related to the student's field of study. No more than 6 units of practicum coursework may be counted towards degree requirements.

IV. **Capstone Course** (3 units)

(A required subject)

Upon completing all or most of the coursework for this program, the student is required to take the capstone course and, under the guidance of the course instructor, integrate the knowledge and skills learned from all of the courses taken during the program.

EE595 Electrical Engineering Capstone Course

- **Course Descriptions**

Master's Degree Programs, School of Engineering

Master's degree courses are numbered in the 500s. Each master's degree program allows for a limited number of credits for 400 level courses with a "G" suffix.

Course No.	Description
450G-499G	Cross-listed specialized skills courses taken for graduate level credits
500-599	Graduate level courses

For information on prerequisite subjects numbered below 450, refer to the section on Course Descriptions for the Undergraduate Degree Programs, School of Engineering.

Courses are listed by subject: Embedded Systems Engineering, Computer Science, Curricular Practicum, Electrical Engineering, and Professional Development.

Each course description is followed by its prerequisite information expressed in course numbers.

Each 1 unit of a practicum course requires at least 45 contact hours of practical experience related to the student's program curriculum.

Embedded Systems Engineering

CE450G Fundamentals of Embedded Engineering (3 units)
This is the first in a series of embedded systems courses designed for students who are interested in learning real-time embedded systems and practicing real-time programming of embedded systems. Topics include hardware issues including platform, microprocessors commonly used in these systems and how a microprocessor works in such systems, concept of memory, registers, I/O; interrupt generation and handling in an embedded system; the concept of real-time programming, multi-task, concurrency, mutual exclusion; overview of real-time kernel/OS, drivers; system initialization and startup, and debug issues. Hands-on exercises are required.
Prerequisite: **CS250**

CE450LG Embedded Engineering Lab (1 unit)
This is a drill course designed to be taken with the course CE450 Fundamentals of Embedded Engineering. The students gain hands-on experience with embedded systems programming and design. They are also guided to work on projects involving controller systems.
Prerequisite: **CS250L**

CE521 Real-Time Systems and Programming (3 units)
This is the second in the embedded systems series. By examining an off-the-shelf real-time operating system, students will gain hands-on experience in real-time operating system programming and implementations. Specific topics include a review of embedded system design, the concept of real-time systems, real-time specification and design techniques, real-time kernels, system performance analysis, memory management, task management, time management, synchronization of inter-task communication, queuing models, real-time operating system tools for embedded systems, and real-time programming examples. Hands-on exercises are required.
Prerequisite: **CE450**

CE522 Embedded Design in Networking Environment (3 units)
This course is designed for the students to learn protocol stack implementation/porting in a real-time operating system (RTOS) kernel environment. Students learn the concept of network protocol stack implementation/porting, embedded real-time system software architecture, and real-time operating systems. They also learn to design and write programs as a collection of independent and concurrent tasks, non-preemptive and preemptive multi-tasking, task scheduling, and task synchronization and intertask communication including semaphores and message queues. Industry standard RTOS will be used for practice and projects.
Prerequisites: **CE450**

CE523 Embedded Design in Device Driver Environment (3 units)

This course investigates the operating system (Windows NT, Linux, or Unix) components that interact with device drivers, the device driver building and debugging process, device driver architecture, functionality and the relevant kernel APIs. Topics include: operating system architecture; I/O API; operating system kernel; building, loading and debugging device drivers; device driver entry points; device driver data structures; I/O request processing; plug, play and power management; interrupts and timers; memory management; direct memory access; and timing. The goal of the course is to present comprehensive coverage of the operating system kernel, HAL, device drivers and the related APIs. Upon completion of the course, the student should be able to develop, build, install and test basic device drivers, as well as to port existing drivers from one operating system to another. Hands-on practice is required.

Prerequisite: **CE450**

CE530 Embedded Software Design in Linux (3 units)

This course prepares students to enter the challenging world of embedded Linux. It covers the following key topics: comparing Linux and traditional embedded environments, comparing leading embedded Linux processors, understanding the details of the Linux kernel initialization process, learning the basic concepts about Linux drivers, learning about the special role of bootloaders in embedded Linux systems - with specific emphasis on U-Boot, using embedded Linux file systems, understanding the Memory Technology Devices subsystem for flash (and other) memory devices, mastering debugging tools such as gdb, KGDB, learning many tips and techniques for debugging within the Linux kernel, learning how to maximize productivity in cross-development environments, learning to prepare an entire development environment, including TFTP, DHCP, and NFS target servers; and learning to configure, build, and initialize BusyBox to support a set of unique requirements. Hands-on exercises are required.

Prerequisite: **CE450**

Computer Science

CS453G Compiler Design (3 units)

This course is designed to give students a fundamental knowledge of compilers and interpreters for modern computer languages. Topics include a study of modern computer languages, regular expressions, lexical analysis, parsing techniques, context-free grammars, and syntax-directed translation. Hands-on exercises and trimester projects are required.

Prerequisite: **CS350**

CS455G Algorithms & Structured Programming (3 units)

This course introduces students to the design, analysis, and implementation of algorithms to solve engineering problems using an object-oriented programming language. It covers the common algorithms, algorithmic complexity, and data structures used to solve these problems. The course concentrates on the design of algorithms and the analysis of their efficiency.

Prerequisite: **CS350**

CS457G Data Modeling and Implementation Techniques (3 units)

This is the first of a series designed to teach relational database concepts, design, and applications. Topics include database architecture, relational model, structured query language (SQL), data manipulation language (DML), data definition language (DDL), database design, ER modeling, database normalization, denormalization, and physical database design. Popular database systems, such as Oracle and Microsoft SQL server, are used for hands-on exercises and projects.

Prerequisite: **CS250**

CS457LG Database Technologies Lab (1 unit)

This is a drill course designed to be taken with the course CS457 Data Modeling and Implementation Techniques. The students gain hands-on experience in database applications using popular database systems including Oracle database and Microsoft SQL server. They are also guided to work on database design projects.

Prerequisite: **CS250L**

CS470G Network Engineering and Management (3 units)

This course is designed to introduce network communications. Topics include network layered models (OSI, TCP/IP), architecture, principles, service models and protocols; data communication basics, switching, routing, security, network management, and wireless and mobile networks. Modern Internet technologies and implementations are presented in case studies. Hands-on exercises are required.

*Prerequisite***: CS250**

CS477G Ethical Hacking and Penetration Testing (3 units)

An ethical hacker is usually employed by an organization which trusts him or her to attempt to penetrate networks and/or computer systems, using the same methods as a hacker, for the purpose of finding and fixing computer security vulnerabilities. This course goes in-depth into the computer hacking techniques. The students leave with the ability to quantitatively assess and measure threats to information assets; and discover where the organization is most vulnerable to hacking. This allows system administrators to deploy proactive countermeasures and stay ahead of information security developments and exploited vulnerabilities.

Prerequisite: **CS250**

CS478G Blockchain Technology and Applications (3 units)

This course explores the fundamentals and applications of blockchain technology; the transparent, secure, immutable and distributed database used currently as the underlying technology for Cryptocurrency. Types of blockchain will be introduced and studied with real-life cases. This course will introduce students to the workings and applications of this potentially disruptive technology and its potential impact, on all aspects of business world and society with practical cases and research assignments.

CS480G Java and Internet Applications (3 units)

This course introduces students to the Java language, programming with object-oriented construct, GUI design and graphics programming, and core Java libraries. Students will learn Java language basics such as syntax and classes, inheritance, interfaces, reflection, graphics programming, event handling, user-interface components with Swing, Java applets, exception handling, stream, and files. Hands-on exercises are required.

Prerequisite: **CS250 or CS360**

CS480LG Java Programming Lab (1 unit)

This is a drill course designed to be taken with the course CS480 Java and Internet Applications. The students gain Java programing skills through hands-on exercises in this weekly lab course. Weekly hands-on exercises normally correspond with the lecture material offered in each week.

Prerequisite: **CS250 or CS360L**

CS481G Introduction to Data Science (3 units)

Data science is an interdisciplinary field that combines mathematics, statistics, programming languages, and specific domain knowledge. The course describes (1) the process of gaining knowledge and insights from data in both a structured and an unstructured way, (2) scientific methods, processes, algorithms, and systems that can be employed to analyze, design, develop, and implement solutions to challenging novel and existing data science problems.

Prerequisite: **MATH208**

CS483G Fundamentals of Artificial Intelligence (3 units)

This course covers artificial intelligence applications in problem solving, reasoning, planning, natural language understanding, computer vision, autonomous car navigation, machine learning, business intelligence, robot design, and so on. In order to solve artificial intelligence problems, the major algorithms include machine learning, search, Markov decision processes, constraint satisfaction, graphical models, and logic. The main goal of the course is to equip students with the tools in Python library to tackle a variety of AI problems in the industries.

Prerequisite: **CS250**

CS483LG Artificial Intelligence & Machine Learning Lab (1 unit)

Students will learn python programming in Google colab platform with numpy, pandas, matplotlib, scikit-learn, seaborn, tensorflow models and Keras API to implement algorithms covered in the lecture from different raw dataset sources. And they will have the chance to build system for several hand-on design projects. In two hours lab session, student will be getting familiar with algorithm functions in above libraries to implement different data processes in machine learning, search, Markov decision processes, constraint satisfaction, graphical models, logic, and optimize design system by plotting data process curves and error analysis in the model.

Prerequisite: **CS250L**

CS485G JavaScript and Internet Programming (3 units)

This course is designed to provide students with advanced programming knowledge and skills for application development on the Internet. Students study both client-side and server-side scripting including HTML, JavaScript, and CSS to develop interactive and responsive web sites. Other topics covered include jQuery, Bootstrap, Node.js Express Framework, RESTful API, MongoDB (NoSQL) and various JavaScript frameworks such as Angular and React. Hands-on exercises are required.

Prerequisite: **CS250**

CS500 Object-Oriented Design in Python (3 units)

This course is designed to use an object-oriented programming language to achieve the goal of teaching the students the object-oriented design methodology for software development. The objective is to develop the students' programming ability with proper logical and object-oriented thinking processes, as well as software design patterns. The course covers three main topics: (1) Object-oriented design and analysis - requirement analysis, design process, data abstraction, encapsulation, aggregation, and inheritance. (2) Design Patterns - reusable solutions to commonly occurring problems such as Abstract Factory, Observer, Command, Decorator, Adaptor, Iterator and State. (3) Python language - data types, control structures, functions, parameter passing, library functions, lists, tuples and dictionaries, I/O, modules, functional programming, and advanced python syntax. Hands-on practices using Python are required.
Prerequisite: **CS250**

CS500L Object-Oriented Design in Python Lab (1 unit)

This course is designed to be taken with the course CS500 Object-oriented Analysis and Design in Python to practice object-oriented design and develop programming skills in Python.
Prerequisite: **CS250**

CS501 Practical Application of Algorithms (3 units)

This course is designed to expand a student's knowledge of algorithms by concentrating on the practical application to solve real-world computational problems. Students will be trained in the process of "Algorithmic Thinking", allowing them to develop a good conceptual understanding and improve the ability to solve challenging problems. Students will learn how to implement abstract algorithmic thoughts in programs, explain them to others, and formulate simpler, more efficient solutions to real-life problems faced during an interview or in the workplace.
Prerequisite: **CS250**

CS510 Advanced UNIX/Linux Programming (3 units)

This course is designed for students to gain fundamental knowledge of and hands-on experience with programming in the UNIX/Linux environment. Students will learn to program in C with UNIX/Linux system calls and other advanced topics such as the UNIX file system, process control, signals and inter-process communications. Students are required to do a term project with a substantial amount of programming. Upon completion of this course, students should be able to develop real-world UNIX/Linux applications. Hands-on practice and projects are required.
Prerequisite: **CS230 and CS250**

CS515 UNIX/Linux Network Programming (3 units)

This course is designed for graduate students to gain hands-on experience in UNIX/Linux network programming. The students will learn to develop UNIX/Linux network applications using a number of UNIX/Linux network programming interface techniques including Sockets, XTI, and RPC. Topics include: an overview of transport layer (TCP/UDP), TCP sockets, UDP sockets, threads and client-server design, XTI, RPC, and Streams. Hands-on exercises and projects are required.
Prerequisite: **CS230 and CS250**

CS521 Software Project Management (3 units)

This course teaches students to apply current software development approaches to managing modern complex software projects. Practical strategies, tactics, and designs are discussed together with realistic exercises. Topics include software development process, project planning, requirements definition, design specification, usability engineering, verification and validation, project and change management, and process quality improvement. Students are required to participate in all course activities to develop a real-world software product.
Prerequisite: **CS250**

CS522 Software Quality Assurance and Test Automation (3 units)

This course teaches students to learn practical static and dynamic techniques that allow software development teams to engineer high quality products. The course begins with an overview of modern software development approaches. It then introduces quality management and test development based on preventive and agile principles as well as quality risk analysis. It covers system, unit, integration, performance, and automated testing techniques. Quality improvement models for software development and testing are discussed. Several test automation tools are demonstrated in class. Students gain hands-on experience through homework assignments and exercises and learn to test real-world applications.
Prerequisite: **CS250**

CS526 Advanced Web Programming (3 units)

This course teaches students to learn how to build modern web applications with web application frameworks. It helps students understand how the web application framework performs, and shows students how to use various features of the framework to solve many problems in real-world development scenarios they're likely to face. In the process,

students will learn how to work with HTML, CSS, JavaScript, the Object-relational Mapping Framework, and other web technologies. Students will start by learning core concepts such as the Model-View-Controller architectural pattern, and then work their way toward advanced topics as well as mobile web development techniques.
Prerequisite: **CS250 or CS480**

CS531 Python Applications Programming (3 units)
This course introduces the fundamental and advanced features of Python programming language and how to utilize them to develop Python applications. The students will start by learning about the development environment, basic syntax, variable types, basic operators, control flows and loops, functions, modules, files I/O, and exceptions. The course further progresses to include advanced topics such as classes/objects, object-oriented programming, regular expressions, multithreading, interface with Linux commands and C programs. Upon completion, the students will be able to develop Python applications that involve CGI programming, database access, networking, XML processing, GUI programming, and functional programming.
Prerequisites: **CS230 and CS500**

CS532 Advanced Internet Programming and Design (3 units)
This course is designed to give the students an in-depth understanding of Java programming techniques. The course focuses on advanced Java language features and packages which are essential for building a variety of application architectures. Topics include Java techniques of XML, JNI, thread, network programming, generic programming concept and internalization. Upon completion of this course, the students should be well prepared to create enterprise-wide, Java-centric solutions to client/server problems involving Java and networks. Each technology topic will cover its uses, implementation, and language issues. Students are required to implement a project for each Java technique. Hands-on exercises are required.
Prerequisite: **CS480**

CS535 Network Security Fundamentals (3 units)
This course addresses the security issues on the internet and the web. Major topics include issues related to internet infrastructure and applications running on the internet, techniques to reduce security risks, and an introduction to the role of security as an enabling technology for electronic commerce. The course includes an overview of internet and web security, its applications and legal issues, encryption and cryptography, SSL and browsers, web servers, and Java security.
Prerequisite: **CS250**

CS540 Advanced Database Administration (3 units)
This course provides an in-depth understanding of the Oracle Database Management System. Emphasis is on the latest Oracle database architecture, database configuration and administration. Topics include logical/physical database layout, database server processes, database creation, various database physical objects; client/server configuration, multi-threaded server configuration, database storage management, database security, database utilities, database monitoring, partitions, and database backup/recovery methods. Hands-on practice is required.
Prerequisite: **CS457**

CS547 Advanced Database Design and Analysis (3 units)
This course is intended for graduate students to further explore database server development and database tuning. The course specifically details procedural extensions to SQL to develop stored procedures, functions, packages and database triggers. In addition, it covers database performance tuning from an application development point of view by exploring query optimizer, database hints, and various database access methods. Hands-on exercises are required.
Prerequisite: **CS457**

CS548 Web Services Techniques and REST Technologies (3 units)
This course covers the fundamental concepts of the 3-tier model commonly used in Enterprise Application development. Topics include the Spring Framework, JDBC with database applications, JPA (Java Persistence API), Hibernate, Spring MVC, Java Servlets, and JavaBeans. In addition, the students will learn the best practice development approach using the Sprint Framework with JDBC or ORM (Object Relational Mapping) tools to map business domain object models to the underlying relational database. At the end of this course, the students shall have a fresh view on both the fundamental and advanced skills to implement large scale enterprise systems. Hands-on exercises are an integral part of the course.
Prerequisite: **CS480**

CS550 Machine Learning and Business Intelligence (3 units)
This course introduces methods and techniques for using stored business data to make business decisions. The student will learn data types including operational or transactional data such as data for sales, cost, and inventory; nonoperational data such as forecast data and macroeconomic data; and meta data, and learn their patterns,

associations, or relationships, and how to use this information for decision making. Modern data warehouse concepts will also be introduced. Specific examples of businesses using data mining techniques will be given in the course. The student is required to work on course projects by using modern data analysis software and referring to cases studied.
Prerequisite: **CS457**

CS551 Mobile Computing for Android Mobile Devices (3 units)
Google's Android mobile phone software platform may be the next major opportunity for application software developers. Android has the potential for removing the barriers to successful development and sales of a new generation of mobile phone application software. Just like PCs which have created markets for desktop and server software, Android will create a new market for mobile applications by providing a standard mobile phone application environment. This hands-on course focuses on developing applications for Android, including map-based applications, camera-based applications, SMS, etc. Advanced development topics are also covered, including security, IPC, and certain advanced graphics and user interface techniques.
Prerequisite: **CS500**

CS556 Mobile Applications on iPhone Platform (3 units)
This course provides an in-depth study of the design, development and publication of object-oriented applications for the iPhone platform using the Apple SDK. Students will learn to utilize Xcode, SwiftUI, and UIKit to create iOS apps for iPhones.
Prerequisite: **CS360 or CS500**

CS565 Advanced Network Management (3 units)
This course is designed to give graduate students an in-depth understanding of and a hands-on experience in the management of network systems and applications. Emphases are on simple network management protocol (SNMP) management, MIB, management tools, system and applications. Current widely-used applications by industry will be used to demonstrate the management concepts. Computer-based training software will be used to check/verify the students' network management skills in order to ensure they are prepared for the industry challenges. Topics include Network Management fundamentals; OSIMAN, SNMP and TMN standards; RMON and ITU TMN architecture; inside structure and practical applications of SNMP, SNMP2, SNMP3, RMON, RMON2, and MIBs. Hands-on exercises are required.
Prerequisite: **CS470**

CS570 Big Data Processing & Analytics (3 units)
This course aims to provide students an understanding in the operating principles and hands-on experience with mainstream Big Data computing systems such MapReduce and Hadoop, and most recently Apache Spark, a fast, in-memory distributed collections framework written in Scala. Applying these techniques to big data processing and analytic problems, such as PageRank, machining learning, and social network graph mining would be discussed.
Prerequisite: **CS500**

CS571 Cloud Computing Infrastructure (3 units)
This course first gives an overview of cloud computing infrastructure, including cloud computing frameworks, patterns, virtualization, and applications, and then discusses container technologies like Docker. According to Gartner (Gartner, Feb - 2019), by 2022, more than 75% of global organizations will be running containerized applications in production. The course then focuses on the discussion of container orchestration system Kubernetes. Kubernetes is taking the app development world by storm. Kubernetes radically changes the way applications are built and deployed in the cloud. Since its introduction in 2014, Kubernetes has become one of the largest and most popular open source projects in the world. Legend has it that Google deploys over two billion application containers a week throughout Kubernetes.
Prerequisite: **CS500**

CS572 Blockchain Development (3 units)
This course teaches the students the basics of blockchain technology as well as languages and tools required to build decentralized applications on the Ethereum platform. This course introduces everything needed to understand the technology, write smart contracts and build applications that interact with them. Participants will learn about the Ethereum platform, the programming language Solidity, how to use Web3.js and the Truffle framework and lastly, how to tie everything together. Step by step, participants build a fully functioning decentralized application, deploy it and test it.
Prerequisite: **CS500**

CS575 Network Analysis and Testing (3 units)
This course covers computer network analysis, testing techniques, and experience-based strategies to isolate and solve network problems. Topics include wiring and cable testing issues, transmission encoding techniques, dissecting the

IEEE 48-bit MAC address, the impact of different types of broadcast traffic, operational details and analysis considerations for switches, Ethernet and Token Ring operational details and analysis, the IEEE 802.2 LLC protocol, datagrams and routing, IP specifics, protocol analysis and troubleshooting, baselining throughput and latency. Hands-on exercises using protocol analyzer are required to reinforce the topics.
Prerequisite: **CS250**

CS581 Cloud Security (3 units)
This course covers the basics of cloud infrastructure technologies such as computers, storage, containers, serverless, IAM, asset management, etc. Challenges of scalability and security in multi-cloud and hybrid-cloud environments are examined. Students will learn how various Cybersecurity principles apply to cloud technology, such as Least Privilege, Defense in Depth, Attack Vector, Trust Boundaries, Shared Responsibility Model, etc.
Prerequisite: **Cloud Computing Fundamentals**

CS589 Special Topics (3 units)
Special topics courses are offered to graduate students in the Computer Science program by current faculty members or invited guest speakers to expose the students to emerging technologies related to their studies. These courses are conducted the same way as regular courses.
Prerequisite: **Depending on topic**

CS595 Computer Science Capstone Course (3 units)
The capstone course is intended to integrate the knowledge and hands-on experience that the student has acquired from the foundation, core, and elective coursework required for the program in the course under the guidance of the course instructor. The instructor determines the course objectives and scope based on the computer science curriculum and technology trend. The instructor guides the students to develop their integration ability. The student shall take the capstone course near the end of his/her program of study.
Prerequisite: **Must be in the final trimester of the program.**

Curricular Practicum

CPT501 Curricular Practicum (1 unit)
Curricular practicum, or curricular practical training, is a supervised practical experience that is the application of previously studied theory. The curricular practicum must provide students a valuable learning experience and must significantly increase their knowledge in their program of study. It is defined as alternative work/study, internship, cooperative education, or any other type of required internship or practicum that is offered by sponsoring employers through cooperative agreements with the school and the course is an integral part of an established curriculum. At least three hours of work in a practical setting has the credit equivalency of one hour of classroom lecture (1 unit). To be eligible to take this course, the student must have obtained a written agreement that outlines the arrangement between the institution and the practicum site (including specific learning objectives, course requirements, and evaluation criteria), and received approval by a designated advisor. F-1 International students must follow additional rules required by the U.S. Immigration and Customs Enforcement. Information and instructions concerning this course are provided in the online application form. This is a part-time practicum course taken by the graduate student to work no more than twenty hours each week during the approved practicum period. Failure in this course will prevent the student from taking any curricular practicum course afterwards.
Prerequisite: Refer to the instructions on the application and agreement documents.

CPT502 Curricular Practicum (2 units)
Curricular practicum, or curricular practical training, is a supervised practical experience that is the application of previously studied theory. The curricular practicum must provide students a valuable learning experience and must significantly increase their knowledge in their program of study. It is defined as alternative work/study, internship, cooperative education, or any other type of required internship or practicum that is offered by sponsoring employers through cooperative agreements with the school and the course is an integral part of an established curriculum. At least three hours of work in a practical setting has the credit equivalency of one hour of classroom lecture (1 unit). To be eligible to take this course, the student must have obtained a written agreement that outlines the arrangement between the institution and the practicum site (including specific learning objectives, course requirements, and evaluation criteria), and received approval by a designated advisor. F-1 International students must follow additional rules required by the U.S. Immigration and Customs Enforcement. Information and instructions concerning this course are provided in the online application form. This is a full-time practicum course taken by the graduate student to work more than twenty hours but not to exceed forty hours each week during the approved practicum period. Failure in this course will prevent the student from taking any curricular practicum course afterwards.
Prerequisite: Refer to the instructions on the application and agreement documents.