Graduate Program Guide

Department of Electrical and Computer Engineering

Northeastern University

Academic Year 2025–2026

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List of Acronyms
CCSP: Communications, Control, and Signal Processing
COE: College of Engineering
CSYS: Computer Systems and Software
CVLA: Computer Vision, Machine Learning, and Algorithms
ECE: Electrical and Computer Engineering
ELPO: Electromagnetics, Plasma, and Optics
FT: Full-time
GAC: Graduate Affairs Committee
GL: Gordon Leadership
GSE: Graduate School of Engineering
HSMI: Hardware and Software for Machine Intelligence
IIRR: Individual Instruction Registration Request
IP: In Progress
MGEN: Multidisciplinary Graduate Engineering
MSC: MSECE, course-only track
MSECE: Master of Science in Electrical and Computer Engineering
MSECEL: Master of Science in Electrical and Computer Engineering Leadership
MSECE+LC: MSECE with Leadership Certificate
MSAI: Master of Science in Artificial Intelligence
MSIoT: Master of Science in Internet of Things
MSMD: Microsystems, materials, and devices
MSSCEN: Master of Science in Semiconductor Engineering
MST: MSECE, course-thesis track
MSWiNE: Master of Science in Wireless and Network Engineering
NU: Northeastern University
NUID: Northeastern University Identification Number
OGS: Office of Global Services
PhD-BE: PhD, BS Entry
PhD-AE: PhD, Advanced Entry
PhDCE: PhD in Computer Engineering
PhDEE: PhD in Electrical Engineering
POWR: Power Systems, Power Electronics, and Motion Control
PT: Part-time
QE: Qualifying Exam
RA: Research Assistant(ship)
ROR: Registration Override Request
SH: Semester Hour
S/U: Satisfactory or Unsatisfactory
TA: Teaching Assistant(ship)
WIoT: Institute for the Wireless Internet of Things

1. General Information

This document provides information about ECE graduate programs at Northeastern University. Graduate students are expected to read this document, be familiar with the rules and procedures, follow them, and refer to this guide when they have questions.

1.1. Graduate Programs and Degrees

The ECE Department offers three graduate programs:
- Master of Science in Electrical and Computer Engineering (MSECE)
- PhD in Electrical Engineering (PhDEE)
- PhD in Computer Engineering (PhDCE)

We also offer two programs in cooperation with the [Gordon Institute of Engineering Leadership](). These programs are:
- the Master of Science in Electrical and Computer Engineering Leadership (MSECEL)
- the MSECE with leadership certificate (MSECE+LC).

In addition, we offer two MS programs co-developed with the [Institute for the Wireless Internet of Things (WIoT)]():
- the Master of Science in Wireless and Network Engineering (WiNE) with WIoT
- the Master of Science in Internet of Things (IoT) with WIoT and the [Khoury College of Computer Sciences (Khoury)]()

Finally, we have three joint MS programs co-led by other departments:
- the Master of Science in Applied Physics and Engineering (MSAPE) with the [College of Sciences (COS)]()
- the Master of Science in Artificial Intelligence (MSAI) with Khoury College
- the Master of Science in Data Science (MSDS) with the Khoury College
- the Master of Science in Robotics (MSROB) with the Mechanical and Industrial Engineering Department [(MIE)]() in the College of Engineering (COE), [Khoury]() and the [Institute for Experiential Robotics (IER)]()
- the Master of Science in Semiconductor Engineering (MSSCEN) with the Mechanical and Industrial Engineering Department [(MIE)]() in the College of Engineering (COE).
- the Master of Science in Extended Reality (MSXR) with Khoury College, D'Amore-McKim, Bouve College, College of Social Sciences and Humanities, and College of Art, Media and Design

All MS programs can be pursued full-time (FT) or part-time (PT). Applicants with a BS or MS degree in electrical and computer engineering or a closely related field can apply to one of the MS programs or one of the PhD programs. In other words, an MS degree is not required to apply to PhD programs. Both PhD Programs are full-time programs and students are required to register in the Fall, Spring, and Summer Full semesters.

1.2. Graduate Advising

PhD students are advised by their research advisor. For advice on rules and regulations, COE PhD Grad Advising ([coe-phd-gradadvising@northeastern.edu]())

Graduate Student Services will advise all MSC and MST students who do not yet have a research advisor on rules and regulations. You can contact COE ECE Grad Advising at [coe-ece-gradadvising@northeastern.edu]()

MST students with a research advisor will be academically advised by their research advisor. The MST research advisor can be any tenured, tenure-track, emeritus, affiliated, or adjunct faculty member in ECE. MST students can change their track to MSC after completing one semester in the ECE Department. MST students who, after two semesters, do not yet have a thesis advisor need to change their track to MSC.

A PhD advisor (or lead advisor in cases of joint advising) can be any ECE tenured, tenure-track, emeritus, affiliated, or adjunct faculty member. All PhD students have a research advisor when they begin the program. In the case of a change in advisor, they should complete a PhD Research Advisor Form and upload it here.

2. The MSECE Program

MS graduates will acquire the necessary analytical and technical knowledge, tools, and skills to address engineering problems of an advanced nature in their field of study by taking core fundamental courses as well as concentration courses in their chosen concentration and by completing a project or thesis if they have selected the thesis track. They will be able to analyze problems and formulate and design appropriate solutions in their specific concentration. These skills shall make them capable of using analytical, numerical, and experimental techniques to achieve these goals.

2.1. MSECE Tracks

MSECE applicants select one of the two tracks, the course-thesis track (MST) or the course-only track (MSC), when they apply for admission. Changing track is possible after finishing one semester in the original track. Please refer to Section 20 for details, conditions, and requirements.

2.2. MSECE Concentrations

MSECE applicants select one of the eight concentrations listed below while applying for admission. These concentrations are:
1. Communications, Control, and Signal Processing (CCSP)
2. Computer Systems and Software (CSYS)
3. Computer Vision, Machine Learning, and Algorithms (CVLA)
4. Electromagnetics, Plasma, and Optics (ELPO)
5. Hardware and Software for Machine Intelligence (HSMI)
6. Microsystems, Materials, and Devices (MSMD)
7. Power Systems, Power Electronics, and Motion Control (POWR)

A change of concentration is only possible at the end of the first or second semester of study in the ECE Department. This is done by filing a petition. Only a fraction of petitions for change of concentration are approved. Details can be found in Sections 20 and 16

2.3. Description of MSECE Concentrations

Communication, Control, and Signal Processing (CCSP)
This concentration focuses on the development of deterministic and stochastic methodologies and algorithms for modeling, analysis, and design of communications, control, and signal processing applications. The main areas of research strength in this concentration include communications, signal processing and robotics techniques for underwater deployment and related applications; wireless communication, coding and information theory, biomedical signal processing, statistical and adaptive signal processing, brain-computer interface, pattern recognition, robust, adaptive, and distributed control, image and video processing, mobile and assistive robotics, detection, estimation, localization and object tracking. Students in this concentration are trained for careers in wireless and mobile communications industry, applications of modern signal and image processing techniques to communications, control, imaging, radar, and sonar and design and analysis of robust and adaptive control systems.

Computer Systems and Software (CSYS)
The Computer Systems and Software concentration prepares students for careers in a wide range of areas including microprocessor design and verification, embedded hardware and software development, performance analysis and modeling, advanced computer system design, and operating system design. Coursework includes computer architecture, simulation and performance evaluation, VLSI design, fault tolerant computing, operating systems, and embedded design. Students will learn the proper design and implementation of both hardware and software systems, including microprocessors and graphics processors, high performance computing, computer- aided design tools, CMOS design rules, compilers, computer arithmetic, resilient computation, advanced logic design, operating systems, power/performance analysis, and hardware/software co- design.

Computer Vision, Machine Learning, and Algorithms (CVLA)
The Computer Vision, Machine Learning, and Algorithms concentration prepares students for careers in a wide range of areas including vision systems, big data analytics and mining, vision/image processing, visualization systems and software, and general algorithmic approaches to problem solving. Coursework includes computer vision, algorithmic approaches, machine learning, pattern recognition, big data analytics and visualization. Students will study image motion and tracking; algorithmic foundations of robotics; applications of parallel and high-performance algorithms; the human visual system and visual cognition; localization, mapping and navigation, and clustering and regression analysis.

Hardware and Software for Machine Intelligence (HSMI)

This concentration will prepare students to become multifaceted systems engineers who can bridge the gap between theory, software, and hardware. As artificial intelligence solutions become more prevalent and widely embraced by society, it will be important that expert practitioners creating these solutions are not only fluent in theoretical and software generation aspects of this technology, but also be knowledgeable about real-world hardware implementation considerations that must be part of the solution/system design and development process. Consequently, graduates of this program will be skilled in developing MI systems that solve problems of importance through hardware-software co-design of efficient real-time, high performance, and distributed MI implementations with security and safety considerations.

Electromagnetics, Plasma, and Optics (ELPO)

This area is concerned with the theory and applications associated with the launching, propagation, confinement, and control of electromagnetic, acoustic, and optical wave fields, and the study and applications of the interaction of such waves with matter. This concentration prepares students for careers in RF and microwave engineering, antenna engineering, radar, sonar, wavefield imaging, remote sensing, optics, photonics, acoustics, magnetics, sensors, and their applications in biomedical electronics, optical fiber and wireless communications, geophysical exploration, radioastronomy, and nanotechnology which rely on the analysis, design, and utilization of wave-based systems and components. Students specializing in this area take courses covering theory and applications of electromagnetics, acoustics, optics, magnetism, modern imaging, photonic devices, biomedical optics, and microwave circuit design.

Microsystems, Materials, and Devices (MSMD)

Students in the Microsystems, Materials, and Devices concentration will learn fundamental theories, design approaches, fabrication methods, and measurement techniques for applications in high performance and miniaturized sensing platforms, wireless devices, biochips, energy harvesting devices, bio sensors, and a variety of other emerging products with electronic components. Students interested in careers in the industry can use standard simulation software tools and equipment. They can also participate in research focused on magnetic, ferroelectric and magnetoelectric materials; design and fabrication of micro/nano electromechanical systems (MEMS/NEMS) devices; design of analog, radio frequency, digital and mixed-signal integrated circuits; and low-power very-large-scale integration (VLSI).

Power Systems, Power Electronics, and Motion Control (POWR)

This concentration covers areas related to secure and efficient operation of electric transmission and distribution systems and design, modeling, and control of power converters and renewable energy systems. Coursework includes power system analysis, unbalanced operation, power electronics, sustainable energy, electric drives, advanced power electronics, and electric machines. Students will learn how to model and analyze large-scale power grids during normal operation and under faults; they will also learn about the principles of the operation of DC-DC converters, inverters, rectifiers, and ac-ac converters, as well as modulation techniques used in power electronics.

2.4. The MSECE Graduate Curriculum

Knowing the meaning of FUNDAMENTAL, CONCENTRATION, and EXCLUDED courses in the graduate curriculum is essential. These notions are only relevant to MSECE students and the PhD-BE students while they are completing their MSECE requirements.

2.4.1. Fundamental Courses

In each concentration, four (4) essential courses offer fundamental knowledge directly related to that concentration. Students must enroll in at least two (2) of these courses.

2.4.2. Concentration Courses

These courses provide depth of knowledge in one of the eight MSECE concentrations. Concentration courses for each concentration are listed starting in section 20. Some courses are listed as concentration for multiple concentrations. Concentration courses can be found in the Northeastern Catalog as well. Note: Fundamental courses are a subset of concentration courses.

Concentration courses can vary slightly based on the students' matriculation year. If a course is listed as a concentration course in the Graduate Program Guide (GPG) of the student's year of matriculation or subsequent years, it is considered a concentration course. Concentration courses can be ECE or non-ECE courses (for instance, several CS and MATH courses are listed as concentration for some concentrations).

No petition is required to register in a concentration course, and this applies to both ECE and non-ECE concentration courses.

In some cases, non-ECE courses that are not listed as concentration courses can be taken as concentration courses if the subject matter is close to the student's concentration. In these cases, a petition needs to be filed and approved before registration in the course, as explained in Section 16

2.4.3. Excluded Courses

These courses cannot be selected as part of the MSECE program and, therefore, cannot be petitioned. These are generally non-ECE courses. Please see Section 21.9 for the list of excluded courses.

3. Checklist for MSECE Course-only Track (MSC) Students

Please use the following checklist for successful progress toward MSECE course-only track:

1. Make sure that you read this document thoroughly and understand all of it. If in doubt, contact your academic advisor in GSE. You need to complete 32 SH of graduate-level course work to graduate. The details are given below.

2. **Fundamental Course Requirements:** Refer to the list of "fundamental courses" for your concentration in Section 21. You need to take at least two fundamental courses (8SH)

3. **Concentration Requirements:** Refer to the list of "Concentration Courses" for your concentration in the NU catalog for the year of your matriculation or on section 21). You need to take and successfully complete at least six "Concentration Courses" (24 SH). Any fundamental course that you take counts as a concentration course.

4. For CCSP, ELPO, MSMD, and POWR students, the total number of non-ECE courses cannot exceed two courses (8 SH). CSYS, CVLA, and HSMI students can take up to three non-ECE courses (12 SH).

5. If MSECE students decide to register in a non-ECE course and cannot for some reason, they need to contact the corresponding department.

6. MSECE students may register once in EECE 6400 (Special Problems in ECE, 1–4 SH) in their MSECE program. Registration in this course requires the approval of a faculty member. If no section of EECE 6400 is available under the name of the approving faculty member, the student should fill out a Registration Override Request (ROR) to request the creation of a section. The ROR to request the creation of a section can be found here. If there is a section in the schedule, the student can register after submitting and receiving the approval of an override form (see Section 16).

7. MSECE students in the course-only track may register once in 4 SH of EECE 7945, Master's Project, as part of their concentration courses. Registration in this course requires the approval of a faculty member. If a section of this course under the name of the approving faculty member does not exist, the student should complete an ROR to request the creation of a section. If there is a section in the schedule, the student can register after submitting and receiving the approval of an override form (see Section 16).

8. A maximum of 9 SH of graduate-level coursework can be transferred from other institutions. Transfer credit is subject to approval of the Graduate Affairs Committee (GAC) and requires filing a petition (see Section 16 on how to file a petition). You need to have a grade of at least B in transfer courses. Courses previously counted towards obtaining a degree cannot be transferred. For more details, see Section 19.

4. Checklist for MSECE Thesis-Course Track (MST) Students

Please use the following checklist for successful progress toward MSECE (thesis-course track):

1. If you do not have a research advisor, please contact your GSE advisors for academic advising. To graduate, you must complete 24 SH of graduate-level coursework plus 8 SH of thesis. The details are given below.

2. Talk to the ECE faculty about their research interests and find a research advisor whose research matches your interests and background and who is willing to serve as your thesis advisor. Your research advisor can be any tenured, tenure-track, emeritus, affiliated, or adjunct ECE faculty member. A list of ECE faculty can be found in the ECE directory. After finding a research advisor, they will be your faculty advisor. The deadline for finding a research advisor is one year after your matriculation at NU. If you cannot find a research advisor, you need to file a petition to change to MSECE course-only track (MSC). For details see Section 20

3. **Fundamental Course Requirements:** Refer to the list of "fundamental courses" for your concentration. You will need to take at least two fundamental courses (8SH).

4. **Concentration Requirements:** Refer to the list of "Concentration Courses" for your concentration in the NU catalog for the year of your matriculation or starting on section 21. You need to take and successfully complete at least six concentration courses (24 SH). Any fundamental course that you take, and your 8 SH of thesis work counts as concentration courses.

5. The total number of non-ECE courses you can take cannot exceed three (12 SH). This applies to all concentrations.

6. If you want to register for a non-ECE course but cannot for some reason, please contact the corresponding department.

7. MSECE students may register once in EECE 6400 (Special Problems in ECE, 1–4 SH) in their MSECE program. Registration in this course requires the approval of a faculty member. If no section of EECE 6400 is available under the name of the approving faculty member, the student should fill out a Registration Override Request (ROR) to request the creation of a section. The ROR to request the creation of a section can be found here. If there is a section in the schedule, the student can register after submitting and receiving the approval of an override form (see Section 16).

8. A maximum of 9 SH of graduate-level coursework can be transferred from other institutions. Transfer credit is subject to approval of the Graduate Affairs Committee (GAC) and requires filing a petition (see Section 16 on how to file a petition). You need to have a grade of at least B in transfer courses. Courses previously counted towards obtaining a degree cannot be transferred. For more details, see Section 19

9. **Thesis Requirements:** First, you must register for EECE 7945 (MS Project), then EECE 7990 (master's Thesis) in a subsequent semester. Registration for these courses requires the approval of a faculty member. If there is no section of EECE 7945 or EECE 7990 available under the name of the approving faculty member, the student should fill out an ROR to request the creation of a section. If there is a section in the schedule, the student can register after submitting and receiving the approval of an override form (see Section 16).

Note 1

If you have not yet successfully defended your thesis after taking both EECE 7945 and EECE 7990, you need to register for one semester in EECE 7996 (Master's Thesis Continuation, 0 SH) to complete your thesis work. If your thesis work is still incomplete after taking one semester of EECE 7996, you need to take EECE 8986 (Master's Research) until you successfully defend your thesis. If a section for EECE 7996 or EECE 8986 under the faculty advisor's name does not exist, the student should complete an ROR to request the creation of a section. If there is a section in the schedule, then a student can register unless there is a restriction, then the student must submit an override form (see Section 16). Upon completion of MS Thesis, a signature page is required.

Note 2

When you are ready to defend your thesis, you must form a "Thesis Committee" in consultation with your advisor. The Committee must have at least three members, with at least two tenured or tenure-track ECE faculty on the committee. After successfully completing EECE 7945 (Master's Project), a letter grade will be assigned to the course. After successfully defending your thesis, a letter grade will be assigned to EECE 7990 (Master's Thesis). Your MS thesis defense date and location must be announced at least one week before the defense date. The MS thesis announcement form can be found here.

Note 3

LATEX templates for writing MS thesis can be downloaded from here. Microsoft Word templates are also available on the COE website. Please ask your graduate advisor for assistance.

5. Checklist for MSECEL Students

Please use the following checklist for successful progress towards MSECEL:

1. Make sure that you read this document thoroughly. In consultation with your Gordon Leadership (GL) advisor, plan a program of study for your degree based on concentration requirements as explained below. If in doubt, contact your GL advisor or your academic advisor in GSE. Ensure that in your plan of study, all prerequisites are taken before registering for a course. To graduate, you need to complete 16 SH of graduate-level coursework plus 16 SH of GL courses, as advised by your GL advisor. The details for the ECE courses are given below. For GL courses and requirements, please consult your GL advisor.

2. **Concentration Requirements:** In consultation with your GL advisor, you must select one of the eight ECE concentrations. Refer to the "Concentration Courses" list for your concentration in the NU catalog for the year of your matriculation or starting on Section 21 You need to take and successfully complete at least four "Concentration Courses" (16 SH).

Note 1
If you plan to take a non-ECE course that is not listed as a concentration course for any ECE concentration, you need to file a petition before registering. See Section 16 on how to file a petition.

Note 2
Courses that are listed under "Excluded Courses" cannot be taken towards the MSECE degree. Please do not file a petition to take these courses. Such petitions are automatically rejected. See Section 21.9 for the list of excluded courses.

3. MSECEL students cannot register in EECE 7945, EECE 7400, EECE 7990, and EECE 7399.
4. Regardless of your concentration, of the 16 SH non-GL courses that you must take, at least 12 SH must be ECE courses.
5. If you want to register for a non-ECE course and cannot, please contact the corresponding department.
6. Excluded Courses:
   a. These courses cannot be selected as part of the MSECE+LC program and, therefore, cannot be petitioned. These are generally non-ECE courses. Please see Section 21.9 for the list of excluded courses.

6. Checklist for MSECE+LC Students

MSECE+LC students must complete 40 SH of coursework, of which 8SH are ENLR courses listed here. The remaining 32 SH follow the same rules as the MST degree except that these students take EECE 7440 and EECE 7442 instead of EECE 7990.

7. The MS in Artificial Intelligence (MSAI)

The MS in Artificial Intelligence provides a comprehensive framework encompassing foundational algorithms, theory, and practical applications in the rapidly evolving field of AI. This program equips students with the essential knowledge and skills to design, develop, and implement AI systems across various high-demand sectors. The core curriculum is designed to provide in-depth understanding of fundamental AI concepts, forming a solid foundation for both theoretical and practical aspects of artificial intelligence.

Computer Vision: Students in the Computer Vision concentration will have the knowledge and skills to drive innovation at the intersection of new and emerging vision systems and AI. Students will be prepared to utilize AI and machine learning solutions for a wide range of applications, including image enhancement/restoration, object recognition, navigation, graphics rendering and pattern classification.

Please using the following checklist for successful completion of MS AI:

- MS AI students are required to complete 32 SH of coursework.
- Complete at least 16 SH of Core Requirements from the approved list.
- Complete at least 8 SH of Concentration Courses from the approved list.
- Complete at least 4 SH of Elective courses from the approved list.
- Capstone: Complete EECE 7945 – Master Project, with supervising faculty.

MS Project Requirements: Registration for this course requires the approval of a faculty member. If there is no section of EECE 7945 available under the name of the approving faculty member, the student should fill out an ROR to request the creation of a section. If there is a section in the schedule, the student can register after submitting and receiving the approval of an override form (see Section 16).

8. The MS in Internet of Things Program (MSIoT)

The MS in Internet of Things (MSIoT) is an interdisciplinary program designed to develop experts and researchers in the growing field of IoT. This program is a collaborative effort by Northeastern's Institute for the Wireless Internet of Things, the Department of Electrical and Computer Engineering in the College of Engineering, and the Khoury College of Computer Sciences. Students in the program acquire comprehensive skills and knowledge to understand, design, implement, and evaluate autonomous wireless networked systems for future applications. This is achieved through a combination of coursework, a master's thesis, supervised research across multiple colleges at Northeastern University, and/or industry experience.

8.1. MSIoT Options

MSIoT applicants may select one of two options, the Coursework option or the Master's Project option, when they apply for admission (see checklist below for details). Changing options is possible after finishing one semester in the originally chosen option. Please refer to Section 18 for details, conditions, and requirements.

Please use the following checklist for successful progress toward MSIoT:

1. MSIoT students are required to complete 32 SH of coursework.
2. Students must choose one of the following options:
   a. **Coursework Option**: requires students to complete at least 28 SH of fundamental courses following the checklist below and at least 4 SH of concentration courses.
      i. Take EECE 5155 – Wireless Senor Networks and the Internet of Things
      ii. One wireless communication/networking course
      iii. One Algorithms course
      iv. One data analysis/machine learning course
      v. One Embedding systems or sensor course
      vi. 4 SH of entrepreneurship, policy, and business courses
      vii. One course in security
      viii. Concentration course from list of COE/Khoury colleges: see Section 23

   b. **Master's Project Option:** requires students to complete at least 28 SH of fundamental courses following the checklist below and at least 4 SH in the form of the MS Project. Students are required to register for EECE 7945 and complete the Masters project in one semester which ends with a written report and presentation of research.
      i. – vii: Same requirements as listed above
      viii. EECE 7945: Master's Project – Refer to Section 16 on registration process.

8.2. MSIoT+LC Option

MS IoT + LC students must complete 40 SH of coursework, of which 8SH are ENLR courses listed here. The remaining 32 SH follow the same rules as the MST degree except that these students take EECE 7440 and EECE 7442 instead of EECE 7990.

9. The MS in Wireless and Network Engineering Program (MSWiNE)

The MS in Wireless and Network Engineering (MSWiNE), offered by the Institute for the Wireless Internet of Things and the Department of Electrical and Computer Engineering, prepares students to become skilled researchers and specialized professionals in today's interconnected world. Through a combination of coursework, master's thesis research, and/or industry experience, students will learn to understand, design, implement, and evaluate current and future wireless and wired communication networks. Additionally, they will have the unique opportunity to gain exceptional research experience at Northeastern's Institute for the Wireless Internet of Things. The program is ideal for those who wish to advance into a PhD program in electrical and computer engineering or a related engineering field.

9.1. MSWiNE Options

MSWiNE applicants select one of two options, the Coursework option, or the Thesis option, when they apply for admission (see checklist below for details). Changing option is possible after finishing one semester in the originally chosen option. Please refer to Section 20 for details, conditions, and requirements.

Please use the following **checklist** for successful progress toward MSWiNE:

1.   MSWiNE students are required to complete 32 SH of coursework.
2.   Students must choose one of the following options:
    a.   MSWiNE students on the Coursework option:
        i.   Take at least 8 SH of fundamental courses from the following: EECE 7374, EECE 5576, EECE 7364
        ii.   Take at least 24 SH of concentration courses from the approved list: see Section 24
    b.   MSWiNE students on the Thesis option:
        i.   Take at least 8 SH of fundamental courses from the following: EECE 7374, EECE 5576, EECE 7364
        ii.   Take at least 16 SH of concentration courses from the approved list: see Section 24
        iii.   Take at least 4 SH of MS Project course – EECE 7945 (a prerequisite to EECE 7990)
        iv.   Take at least 4 SH of MS Thesis course - EECE 7990

Thesis Requirements: First, you must register for EECE 7945 (MS Project), then EECE 7990 (Master's Thesis) in a subsequent semester. Registration for these courses requires the approval of a faculty member. If there is no section of EECE 7945 or EECE 7990 available under the name of the approving faculty member, the student should fill out an ROR to request the creation of a section. If there is a section in the schedule, the student can register after submitting and receiving the approval of an override form (see Section 16). The student must announce their MS Thesis Defense at least one week prior to the event here. Upon completion of MS Thesis, a signature page is required.

10. The MS in Semiconductor Enginerring (MSSCEN)

The MS in Semiconductor Engineering (MS SCEN) aims to bridge the gap between cutting-edge research and practical applications. NanoSI is a world-leading global institute focused on semiconductor research, education, and entrepreneurship. It is at the forefront of semiconductors and NanoSystems research in the country, including next generation chip-scale electronics, sensors, RF – mmWave devices and systems, photonics, MEMS, packaging, heterogeneous integration, and micro/nano manufacturing. All these will be key components of the program that significantly enhances the knowledge, research skills and practical abilities of graduate students.

10.1. MS SCEN Concentrations:

MS SCEN students may apply to one of two concentrations. Students who apply to the Devices and NanoSystem Concentration, please follow the requirements below. Students who apply to the Materials and Manufacturing Concentration, please follow the link provided and connect with your Program Contacts for program requirements and expectations. Students who wish to change concentrations must reapply here. Once accepted, refer to *Section 18* for details, conditions and requirements.
Please use the following checklist for successful progress towards MS-SCEN

1. MS-SCEN students are required to complete 32 SH of coursework
2. Students must choose one of the following three options:

   a. **Coursework Option**: requires students to complete 32 SH of Core, Concentration, and Restricted Electives following the checklist below.
      i. Students are required to complete a minimum of 12 SH of Core Requirements from the approved list.
         1. Students may not meet the Innovation requirement solely with Directed Study coursework.
      ii. Students are required to complete 8 SH of Concentration courses from the approved list.
      iii. Students are required to complete 12 SH from the Restricted Elective Course list.

   b. **Master's Project Option:** requires students to complete at least 28 SH of Core, Concentration, and Restricted Elective courses following the checklist below and at least 4 SH in the form of the MS Project. Students are required to register for EECE 7945 and complete the Masters project in one semester which ends with a written report and presentation of research.
      i. Students are required to complete a minimum of 12 SH of Core Requirements from the approved list.
         1. Students may not meet the Innovation requirement solely with Directed Study coursework.
      ii. Students are required to complete 8 SH of Concentration courses from the approved list.
      iii. Students are required to complete 8 SH from the Restricted Elective Course list.

iv. Students are required to complete 4 SH of MS Project taken over the course of one semester. Registration in this course requires the approval of a faculty member. If a section of this course under the name of the approving faculty member does not exist, the student should complete an ROR to request the creation of a section. If there is a section in the schedule, the student can register after submitting and receiving the approval of an override form *(see Section* 16).

c. **Master's Thesis Option:** requires students to complete at least 24 SH of Core, Concentration, and Restricted Elective courses following the checklist below and at least 4 SH in the form of the MS Project and 4 SH of MS Thesis. Students are required to register for EECE 7945 and complete the Masters project in one semester which ends with a written report and presentation of research. In the following semester, the student is required to register for EECE 7990 which ends with an MS Thesis Defense.

   i. Students are required to complete a minimum of 12 SH of Core Requirements from the approved list.
     1. Students may not meet the Innovation requirement solely with Directed Study coursework.

   ii. Students are required to complete 8 SH of Concentration courses from the approved list.

   iii. Students are required to complete 4 SH from the Restricted Elective Course list.

   iv. Students are required to first complete 4 SH of MS Project followed by 4 SH of MS Thesis in a subsequent semester. Registration in this course requires the approval of a faculty member. If a section of this course under the name of the approving faculty member does not exist, the student should complete an *ROR* to request the creation of a section. If there is a section in the schedule, the student can register after submitting and receiving the approval of an override form (see Section 16). For Thesis Committee and process requirements, please refer Section 4 item 9. The student must announce their MS Thesis Defense at least one week prior to the event here. Upon completion of MS Thesis, a signature page is required.

11. The PhD Program

11.1.   Program Goals
PhD graduates will acquire the necessary analytical and technical knowledge, tools, and skills to address engineering problems of an advanced nature and conduct independent research in their area of specialization by taking courses in the fields of Electrical Engineering or Computer Engineering, proposing a research topic accomplishing their formulated research goals, and defending their dissertation. They will be able to analyze problems and formulate and design appropriate solutions, propose research ideas and topics, conduct research, and produce new knowledge in their field of study. They will possess skills and knowledge that make them capable of using analytical, numerical, and experimental techniques to achieve these goals.

11.2.   PhD Concentrations
PhD students can enter the PhD program either with a BS degree (PhD-BE) or with a Master's in a relevant major (PhD-AE):

- **Applicants with a BS degree (PhD-BE, or PhD, BS entry):**
    - PhDCE students need to first complete degree requirements in one of the four concentrations of CSYS, CVLA, or HSMI.
    - PhDEE students will complete their master's program requirements in one of the four concentrations of CCSP, ELPO, MSMD, or POWR.

After finishing Master's requirements, the rest of their PhD program will follow the requirements of PhD-AE students as described below.

- **Applicants with a master's degree (PhD-AE or PhD, Advanced entry):**
    The notion of concentration does not directly apply to PhD-AE students.

A change of concentration and program (from PhDCE to PhDEE or vice versa, and from PhD programs to MSECE) is possible after completing one semester in the original program/concentration. For details, see section 20.

12. Checklist for PhD Students with MS Degree (PhD, Advanced entry)

1. On academic matters, you will be advised by the GSE advisors.

2. You are assigned a research advisor upon matriculation. If you change your research advisor, please complete the research advisor form found here, have it signed by your new research advisor, and upload it here.

3. Course Requirements: You need to complete at least 16 SH of graduate level course work beyond MS degree.

   Note 1   Courses are selected in consultation with your research advisor.

   Note 2   At least 8 SH of your courses must be graduate-level ECE courses.

   Note 3   If you plan to register in a non-ECE course that is not on the approved list of Concentration courses, you need to file a petition before registration in the course. Please see Section 16 on how to file a petition.

   Note 4   PhD students may register once in EECE7400 (Special Problems in ECE) for 1-4 SH in their PhD program. Registration in this course requires approval of a faculty member. If there is no section of EECE 7400 available under the name of the approving faculty member, the student should fill out a Registration Override Request (ROR) to request the creation of a section. The ROR form can be found here, to request creation of a section. If there is a section in the schedule, then the student will be able to register after submitting and approval of an override form (see Section 16).

   Note 5   A maximum of 4 SH of graduate level course work can be transferred from other institutions. Transfer credit is subject to approval of the Graduate Affairs Committee (GAC) and requires filing a petition (see Section 16. You need to have a grade of at least B in transfer courses. Transfer courses should not have been previously counted towards obtaining a degree.

1. **Qualifying Exam:** You have two chances to pass the QE. The details of the exam can be found in section 14.1

   After passing the qualifying exam, your status changes from "Predoctoral Student" to "PhD Candidate". This stage is usually marked by "Candidacy Achieved".

   If you want to do research before achieving PhD candidacy (i.e., before becoming a PhD candidate as explained above), you need to register in EECE 9986 (Research, 0 SH) under your advisor's name. Registration in this course requires approval of a faculty member. If there is no section of EECE 9986 available under the name of the approving faculty member, the student should fill out a Registration Override Form (ROR), to request the creation of a section. The ROR form can be found here, to request creation of a section. If there is a section in the schedule, then the student will be able to register after submitting and approval of an override form (see Section 16).

2. You must register in EECE 9990 and EECE 9991 (Dissertation Term 1 and Dissertation Term 2, 0 SH) for two consecutive semesters immediately after achieving PhD candidacy. If a section of this course under the name your research advisor does not exist, please contact your academic advisor at GSE.

   Note If after taking EECE 9990 and EECE 9991 you have not yet defended your dissertation (this is very common), you must register in EECE 9996 (Dissertation Continuation, 0SH) in each fall, spring, and summer semesters until you successfully defend your dissertation. During the Summer Full semester you are required to register for a dissertation course. If you plan to take the summer off, you must take a Leave of Absence. Reach out to coe-phd-gradadvising@northeastern.edu for assistance.

3. **PhD Committee**: You should form your "PhD Committee" in consultation with your advisor within one year of passing the QE. For part-time students the deadline is two years after passing the QE. Note that you can form your PhD committee before passing the qualifying exam. It is highly recommended that you form your committee early in your PhD program. The PhD Committee must have at least three members, of which at least two must be tenured or tenure- track ECE faculty, and at least three members must hold doctorate degrees. At least one member of your PhD committee must not have primary assignment in the ECE department. After forming the Committee you complete in the PhD Committee Form and upload it here. For details, see Section 14.2

4. **Dissertation Proposal Review** (sometimes referred to as the "Comprehensive Exam" or "Proposal Defense"): The Dissertation Proposal Review consists of a written research proposal and a presentation of it followed by a question/answer session by the PhD Committee. The presentation part of this exam is open to faculty and students. The date of the Dissertation Proposal Review is determined by your research advisor and PhD Committee. This date is after you have achieved PhD candidacy, have taken EECE 9990 and EECE 9991, and have formed your PhD Committee. It is recommended that the Dissertation Proposal Review be scheduled within two years after passing the qualifying exam (four years for part-time students). To announce your PhD proposal, review please complete and submit the Proposal Review Announcement Form. After successful defense of the proposal, you complete the Dissertation Proposal Review Form. This form is signed by your advisor and the PhD committee members and upload it here. If the proposal review is not successful, the Committee provides recommendations on the direction of the research and arranges a date for future review. For details, see Section 14.3

5. **Dissertation Defense:** Dissertation defense is the last stage in PhD requirements. The dissertation defense consists of a presentation of your research results followed by a question/answer session by your PhD Committee. The presentation part of this exam is open to faculty and students. Prior to scheduling, it is the responsibility of the student to ensure all Dissertation and Dissertation Continuation courses are graded by their PhD Advisor. If any courses are left ungraded, the student cannot Defend or proceed to graduate. The dissertation defense must be scheduled not sooner than six months after the date of the dissertation proposal review. This is a very important scheduling restriction, please make sure to schedule your dissertation proposal review on time in order to meet this requirement. To announce your PhD defense, please complete and submit the Dissertation Defense Announcement Form. For details, see Section 14.4

6. **Residency Requirement:** You need to be registered full-time at NU for at least two semesters after candidacy to be eligible for your degree. The two summer half-semesters count as one full semester..

7. **Time Limitation:** After the establishment of degree candidacy, a maximum of five years will be allowed for the completion of the degree requirements. This time limit applies to all PhD students, PhD-BE and PhD-AE. Under extenuating circumstances, a student may request an extension of this time frame.

8. You graduate when you have successfully defended your dissertation and fulfilled your course and residency requirements.

   For more details on stages and deadlines for PhD students see Section 14

13. Checklist for PhD Students with no MS Degree (PhD, BS entry)

1. On academic matters, you will be advised by the GSE advisors.

2. **Course Requirements**: You need to satisfy the requirements of MSC or MST, plus the course requirements for PhD students with MS. Please refer to the corresponding sections in this document for details.

   Note 1   The decision on whether you should follow the requirements of MST or MSC is made in consultation with your research advisor.

   Note 2   PhDCE students must complete the MSECE requirements for one of the four concentrations CSYS, CVLA, and HSMI. PhDEE students must complete MSECE requirements in one of the four concentrations CCSP, ELPO, MSMD, and POWR.

   Note 3   After completing the requirements for MST or MSC, students may file a petition to receive an MSECE degree. The students must produce a list of the courses that they want to count towards their MS degree and attach the list to their petition; these courses must satisfy the degree requirements in the concentration of the student. Approval of their research advisor is necessary to receive the MSECE degree.

3. **Qualifying Exam, Dissertation Proposal Review, Dissertation Defense**: These requirements are similar to those on "Checklist for PhD Students with MS Degree". Please refer to sections 14 - 14.4

4. **Residency Requirement**: Students need to be registered full-time at NU for at least two semesters after candidacy to be eligible for your degree. The two summer half-semesters count as one full semester.

5. **Time Limitation:** After the establishment of degree candidacy, a maximum of five years will be allowed for the completion of the degree requirements. This time limit applies to all PhD students, PhD-BE and PhD-AE. Under extenuating circumstances, a student may request an extension of this time frame.

   For more details on stages and deadlines for PhD students see Section 14

14. Stages and Deadlines in the PhD Program

The purpose of this section is to present procedures and deadlines, beyond the course requirements, needed to complete the ECE PhD degrees.
These requirements are:

1. Passing the Qualifying exam
2. Forming the PhD committee and filing the PhD Committee Form found here
3. Completing the "Dissertation Proposal Review" stage and filing the Dissertation Proposal Review Form found here
4. Defending the dissertation and filing it with the GSE. Defense cannot be scheduled less than six months after the dissertation proposal review.

14.1.   The Qualifying Exam and Candidacy Achievement

Taking the QE is an important stage in the completion of requirements for the PhD program. Students have two chances to take the QE exam. Students who do not successfully complete the exam the first time must take it at the next deadline. Students who do not successfully complete the exam the second time must leave the PhD program. The process and deadlines for the QE are explained below. Students are responsible for ensuring the process is followed and the deadlines are met.

1. **Deadlines:** There are two deadlines: one for submission of the QE proposal form and one for reporting the result of the exam. These deadlines depend on your semester of entry to the PhD program. Missing either of these deadlines is equivalent to failing the exam.

    a. **The deadline for submission of the proposal form**: For students who entered the program in Fall 2025, the deadline is September 30, 2026. For students who entered the PhD program in Spring 2026, the deadline is March 31, 2027.

    b. **The deadline for reporting the result:** For students who entered the PhD program in Fall 2025, the deadline is December 31, 2026. For students who entered the PhD program in Spring 2026, the deadline is June 30, 2027.

2. **Process**
   a. You and your advisor form the QE committee, which can also serve as your PhD committee, or can be different. The committee must have at least three members. At least two members must be tenured or tenure-track ECE faculty. Your advisor will be one of the committee members.
   b. Complete the QE Proposal Form, which can be found [here.](#) This must be completed by the deadline for submission outlined above. Submit QE Proposal [Form here.](#)
   c. Take the exam. The exam consists of A) a written report on the subject that was stated in our proposal. The report is submitted to your committee before the date of the exam, a presentation of the subject to your committee with a length of 20 minutes, at most, a Q&A session by the committee, which should be 40 to 50 minutes. The questions can be about your report or can test your general knowledge.
   d. Your advisor will send the results of the exam via email to Professor Masoud Salehi, salehi@northeastern.edu and Peter Krafka, [p.krafka@northeastern.edu.](mailto:p.krafka@northeastern.edu) The committee members and the student should be cc'd as well. This must be completed by the deadline for reporting the results outlined above.

3. **Recommendations:** Please schedule submission of the proposal and exam well before the deadlines to ensure the deadline will be met. The deadlines are during busy times for faculty. Advanced planning will allow a time buffer in the case of unforeseen circumstances. After the exam, please ask your advisor to report the results as soon as possible, preferably the day of the exam.

14.2. Forming the PhD Committee

The PhD committee must have at least three members, of which at least two must be tenured or tenure- track ECE faculty and at least three members must hold doctorate degrees. If a student has co-advisors, the entire advisory team will collectively count as one committee member. At least one member of your PhD committee must not have primary assignment in the ECE department. After forming this committee, the PhD Committee Form is completed, signed by the advisor, the Committee members, and the student, and filed as explained in the preceding sections. This form can be found [here.](#) The deadline for filing this form is one year after the deadline for reporting the QE result (see section [12.3](#)).

If the composition of the P.D. committee changes, a new [PhD Committee Form](#) should be filed.

14.3. Dissertation Proposal Review

For the dissertation proposal review, the student prepares a written research proposal and presents it orally. The presentation is open to the faculty and the students and is followed by a closed question/answer session by the PhD committee. The form to announce the presentation

can be found [here and the announcement must be made at least one week before the date of the event.](#) The main factors considered by the committee in reviewing the proposal are:

1. Merit of the proposed research as a PhD dissertation

2. Substantial evidence of progress in research

3. Knowledge of general area of research and related work

4. Ability of oral presentation of the results and answering questions related to the proposal.

The date of the Dissertation Proposal Review is determined by the research advisor and the PhD committee. This date is after the student has achieved PhD candidacy, has taken EECE 9990 and EECE 9991, and has formed his/her PhD Committee. It is highly recommended that the Dissertation Proposal Review be scheduled within two years after passing the qualifying exam. Since the dissertation defense cannot be scheduled less than six months after proposal review, it is important that students schedule their proposal review well ahead of their defense.

After successful defense of the proposal, the student completes the Dissertation Proposal Review Form found [here](#). This form is signed by the advisor and the PhD committee and uploaded [here](#). If the proposal review is not successful, the PhD committee submits written recommendations to the student on the direction of the research and arranges a date for a future review.

14.4. Dissertation Defense

Dissertation defense must be scheduled no sooner than six months after the date of the dissertation proposal review. Prior to scheduling the Defense, it is the responsibility of the student to ensure all Dissertation and Dissertation Continuation courses are graded by their PhD Advisor. If any courses are left ungraded, the student cannot Defend and proceed to Graduate. The form to announce dissertation defense can be found [here.](#) LATEX templates for preparing PhD dissertation can be found [here.](#) Microsoft Word templates are also available on the COE website, please ask your advisor for assistance.

14.5. Residency Requirement

PhD students need to be registered full-time at NU for at least two semesters after achieving candidacy to be eligible for degree. The two summer half-semesters count as one full semester.

14.6. PhD Program Financial Funding

Funding is contingent upon the availability of funds and satisfactory research progress, as determined by the advisor. For additional inquiries, please contact p.krafka@northeastern.edu

14.7. Time Limitation

After the establishment of degree candidacy, a maximum of five years will be allowed for the completion of the degree requirements. This time limit applies to all PhD students, PhD-BE and PhD-AE.

15. PhD Annual Review

All PhD students are reviewed annually by their advisor. The annual review is administered by the GSE, and the details of the process can be found on the GSE website.

Students who receive an "Unsatisfactory" grade will be put on probation and are to meet with their advisor to receive the necessary feedback. The student will be reviewed over the following 6-months. If, by October 15th, they have not improved, they will be removed from the program. Students who receive a "Needs Improvement" grade are encouraged to meet with their advisor and make necessary adjustments to improve their performance.

Students who receive a "Needs Improvement" grade are encouraged to meet with their advisor and make necessary adjustments to improve their performance. Students may not receive "Needs Improvement" two years in a row. Students who earn this mark, are marked as "Unsatisfactory and will be placed on probation. Students who receive "Unsatisfactory" grades in two consecutive years are terminated from the PhD program.

16. Petition and Registration Override Procedures

Please note the following:

- Petitions/overrides for taking courses must be filed and approved BEFORE registration in the course.

- Filing a petition/override does not mean that it will be approved, you need to receive the approval to go ahead.

- Please file your petitions/overrides well in advance. Processing a petition/override takes at least 5 business days.

To file a petition or overrides form go to the Graduate Forms page and click on the relevant link to file a petition or override request. Make sure that you attach your transcripts to your petitions. Petitions without a transcript will not be processed.

The Graduate School uses DocuSign Powerforms for all forms. Students should complete the form and submit it to be emailed to the Assistant Director of Graduate Programs (pkrafka@northeastern.edu). Note that PhD students and MS-Thesis students also need to

send the form to their research advisor (if applicable). If approved, the form will be sent to the Graduate School for review. When the form is complete, a copy will be emailed to the student for their records, and a copy will be placed in their student e-folder. If you have any questions or concerns regarding the form or the process, please feel free to contact the Graduate School at coe-ece-gradadvising@northeastern.edu

17. Probation Policies and Procedures

For details, please refer to the College of Engineering web site at [Probation Policies.](#)

18. Coop and Internship Policies and Procedures

Coop and internship are forms of CPT (Curricular Practical Training) that allow full-time students to integrate a practical learning experience into their graduate program.

For more information on CPT-internship, see the [Graduate Coop](#) page.

19. Policies and Procedures for Course Transfer

MS Programs (MSECE, MSIoT, MSWiNE, MSRobo, MSSCEN, MSXR), PhD-BE, and PhD-AE students can transfer a maximum of 9 SH, 14SH, and 4SH (or equivalent) of course work from other institutions, respectively. 4 SH of course work is defined as 45 hours of lecture. For credit transfer from other institutions, the following conditions must be satisfied:

- The student should have a grade of at least B (or equivalent) in the course.
- The course should not be part of the requirements of a degree received by the student in the past.
- The course will be reviewed by the Graduate Affairs Committee and if recognized as a valid graduate-level course, the credit transfer is approved.
- Transfer credits must have been earned within five academic years of the date of matriculation.

The process for transfer credit requires filing a petition (see Section 16). The petition should be accompanied by the transcript of the student indicating the grade and the time the was passed, the detailed syllabus of the course, as well as sufficient evidence that the course has not been
part of the requirements of a degree received by the student. Evidence should be noted on the transcripts confirming credits were not used towards a degree in the former institution.

20. Policies and Procedures for Requesting Change in the Graduate Program

In general, changes to the graduate program are possible after completing at least one semester at Northeastern. This gives the students an opportunity to get accurate information about each program to make an informed decision. The only request for change in the program that can be requested during the first semester is change from full-time to part-time or from part-time to full-time. This change does not apply to those who hold an F-1 student visa.

- Change from FT to PT or PT to FT. This is the only change that can be petitioned during the first semester. To request this change you need to file a petition as explained in Section 16. Please use a Standard Petition to change your status.

- Change of concentration for MS students (MSC and MST): To apply for a change of concentration, a minimum cumulative GPA of 3.00 is required. Students can apply for a change of concentration if they have earned not more than 16 SH. Students must also have taken and successfully completed two courses in the concentration they are attempting to change into. Part-time students can apply for change of concentration if they have taken at least 8 SH, but not more than 16 SH of course work. For both full time and part time students, the "Introduction to Cooperative Education" course is excluded when counting the 16 SH limit. To request a change of concentration, the student needs to file a "Change in Degree Program/Concentration" form and upload it with their transcripts to a portal whose link is communicated to students each semester. The deadline for submission of the change of concentration form is 11:59 PM on the last day of classes in each semester; this is a hard deadline. After approval the student can a petition for change of concentration (see Section 16).

- Change from MST to MSC: This is done by filing a petition (see Section 16) after finishing at least one semester at NU.

- Change from MSC to MST: In addition to filing a petition (see Section 16) the student needs the approval of an ECE faculty (tenured/tenure track, emeritus, affiliated, or adjunct) to be their thesis advisor. Either the signature of the advisor must be on the petition or a letter from the advisor must be attached to the form.

- Change from PhDEE to PhDCE or from PhDCE to PhDEE: The student needs to file a petition (see Section 16). In addition to the petition, they also need to complete a new application by creating a new account. Their application fee will be waived. If at the same time the student is also changing his/her research advisor, they also need to file a new PhD Research Advisor Form.

For International Students Only: An approved change of program requires that a new I-20 be issued. It is the student's responsibility to initiate the I-20 process. Instructions are provided on the official admission acceptance letter. Questions should be directed to the OGS personnel on campus.

- Change from PhD to MS: The student needs to file a petition (see Section 16). Signature of the research advisor is required.

- Change from MS to PhD: The student must file a petition (see Section 16) and complete a new application in Slate by creating a new account, the application fee will be waived.

Plus-One Students: Can change concentration at any time if they have the minimum 3.0 cumulative GPA and have taken at least 2 courses in the desired concentration. Additional Information: Plus-One Information

21. Fundamental, Concentration, and Excluded Courses

21.1. Communication, Control, and Signal Processing (CCSP)

Fundamental Courses:
EECE 5576 Wireless Communication Systems 4 SH
EECE 5666 Digital Signal Processing 4 SH
EECE 7200 Linear Systems Analysis 4 SH
EECE 7204 Applied Probability and Stochastic Processes 4 SH

Concentration Courses:
EECE 5115 Dynamical Systems in Biological Engineering 4 SH
EECE 5550 Mobile Robotics 4 SH
EECE 5552 Principles of Assistive Robotics 4 SH
EECE 5576 Wireless Communication Systems 4 SH
EECE 5578 Terahertz Communication 4 SH
EECE 5580 Classical Control Systems 4 SH
EECE 5582 Making Systems Reliable – An Introduction to Coding Theory 4 SH
EECE 5610 Digital Control Systems 4 SH
EECE 5612 Statistical Inference: An Introduction for Engineers and Data Analysts 4 SH
EECE 5626 Image Processing and Pattern Recognition 4 SH
EECE 5665 Signal Processing for Global Navigation Satellite Systems 4 SH
EECE 5666 Digital Signal Processing 4 SH
EECE 5698 Special Topics: Feedback Control Systems: Applications to Unmanned Aerial Vehicles 4 SH
EECE 5698 Special Topics: Formal Methods for Dynamical Systems 4 SH
EECE 5698 Special Topics: GNSS Signal Processing 4 SH
EECE 5698 Special Topics: Introduction to Molecular Systems Biology Dynamic Modeling 4 SH
EECE 5698 Special Topics: Spectrum Policy Issues for Wireless Communication Innovators 4 SH
EECE 6400 Special Problems in ECE 4 SH
   (For MSECE and PhD-BS students only)
EECE 7200 Linear Systems Analysis 4 SH
EECE 7204 Applied Probability and Stochastic Processes 4 SH
EECE 7211 Nonlinear Control 4 SH
EECE 7213 System Identification and Adaptive Control 4 SH
EECE 7214 Optimal and Robust Control 4 SH
EECE 7215 Introduction to Distributed Intelligence 4 SH
EECE 7223 Riemannian Optimization 4 SH
EECE 7310 Modern Signal Processing 4 SH
EECE 7311 Two-Dimensional Signal and Image Processing 4 SH
EECE 7315 Digital Image Processing 4 SH
EECE 7323 Numerical Optimization Methods 4 SH
EECE 7324 Experimental Approach to Wireless Communication 4 SH
EECE 7336 Digital Communications 4 SH
EECE 7337 Information Theory 4 SH
EECE 7345 Big Data and Sparsity in Control, Machine Learning, and Optimization 4 SH
EECE 7346 Probabilistic System Modeling and Analysis 4 SH
EECE 7398 Special Topics: Advances in Communication Electronics 4 SH
EECE 7398 Special Topics: Advances in Wireless Communication 4 SH
EECE 7398 Special Topics: Bayesian Filtering and Tracking 4 SH
EECE 7398 Special Topics: Current Research in Nonlinear Systems 4 SH
EECE 7398 Special Topics: Distributed Intelligence 4 SH
EECE 7398 Special Topics: Legged Robots 4 SH
EECE 7398 Special Topics: Systems Modeling and Analysis 4 SH
EECE 7399 Preparing High Stakes Written and Oral Materials 4 SH
   (only for PhD and MST students)
EECE 7400 Advanced Special Problems in ECE 4 SH
   (PhD-AE students only)
ME 7247 Advanced Control Engineering 4 SH

21.2. Computer Systems and Software (CSYS)

Fundamental Courses:
EECE 5640 High Performance Computing 4 SH
EECE 7205 Fundamentals of Computer Engineering 4 SH
EECE 7352 Computer Architecture 4 SH
EECE 7376 Operating Systems: Interface and Implementation 4 SH

Concentration Courses:
EECE 5552 Principles of Assistive Robotics 4 SH
EECE 5640 High Performance Computing 4 SH
EECE 5643 Simulation and Performance Evaluation 4 SH
EECE 5698 Special Topics: Cyber-Physical Security of IoT Systems in the Age of AI 4 SH
EECE 5698 Special Topics: Field Programmable Gate Arrays in the Cloud 4 SH
EECE 5698 Special Topics: Nano-Computing System Design 4 SH
EECE 5699 Computer Hardware and System Security 4 SH
EECE 6400 Special Problems in ECE 1-4 SH
   (For MSECE and PhD-BS students only)
EECE 7205 Fundamentals of Computer Engineering 4 SH
EECE 7352 Computer Architecture 4 SH
EECE 7353 VLSI Design 4 SH
EECE 7368 High-Level Design of Hardware & Software Systems 4 SH
EECE 7376 Operating Systems: Interface and Implementation 4 SH
EECE 7390 Computer Hardware Security 4 SH
EECE 7398 Special Topics: Advanced Computer Architecture 4 SH
EECE 7398 Special Topics: Compilers 4 SH
EECE 7399 Preparing High Stakes Written and Oral Materials 4 SH
   (only for PhD and MST students)
EECE 7400 Advanced Special Problems in ECE 1-4 SH
   (For PhD-AE students only)
CS 5200 Database Systems Management 4 SH
CS 5500 Foundations of Software Engineering 4 SH
CS 5600 Computer Systems 4 SH
CS 6410 Compilers 4 SH
CS 6510 Advanced Software Development 4 SH
CS 6650 Building Scalable Distributed Systems 4 SH

21.3. Computer Vision, Machine Learning, and Algorithms (CVLA)

Fundamental Courses:
EECE 5554 Robotics Sensing and Navigation 4 SH
EECE 5644 Introduction to Machine Learning and Pattern Recognition 4 SH
EECE 7205 Fundamentals of Computer Engineering 4 SH
EECE 7352 Computer Architecture 4 SH

Concentration Courses:
EECE 5360 Combinatorial Optimization 4 SH
EECE 5512 Networked XR System 4 SH
EECE 5550 Mobile Robotics 4 SH
EECE 5554 Robotics Sensing and Navigation 4 SH
EECE 5612 Statistical Inference: An Introduction for Engineers and Data Analysts 4 SH
EECE 5614 Reinforcement Learning and Decision Making Under Uncertainty 4 SH
EECE 5626 Image Processing and Pattern Recognition 4 SH
EECE 5639 Computer Vision 4 SH
EECE 5640 High Performance Computing 4 SH
EECE 5642 Data Visualization 4 SH
EECE 5644 Introduction to Machine Learning and Pattern Recognition 4 SH
EECE 5645 Parallel Processing for Data Analytics 4 SH
EECE 5668 Large Language Models 4 SH
EECE 5698 Special Topics: Cyber-Physical Security of IoT Systems in the Age of AI 4 SH
EECE 5698 Special Topics: Formal Methods of Dynamical Systems 4 SH
EECE 5698 Special Topics: Visual Sensing & Computing Co-Design Edge Machine Perception 4 SH
EECE 6400 Special Problems in ECE 1-4 SH
   (For MSECE and PhD-BS students only)
EECE 7150 Autonomous Field Robotics 4 SH
EECE 7204 Applied Probability and Stochastic Processes 4 SH
EECE 7205 Fundamentals of Computer Engineering 4 SH
EECE 7215 Introduction to Distributed Intelligence 4 SH
EECE 7223 Riemannian Optimization 4 SH
EECE 7268 Verifiable Machine Learning 4 SH
EECE 7311 Two-Dimensional Signal and Image Processing 4 SH
EECE 7315 Digital Image Processing 4 SH
EECE 7323 Numerical Optimization Methods 4 SH
EECE 7337 Information Theory 4 SH
EECE 7345 Big Data and Sparsity in Control, Machine Learning and Optimization 4 SH
EECE 7346 Probabilistic System Modeling and Analysis 4 SH
EECE 7352 Computer Architecture 4 SH
EECE 7370 Advanced Computer Vision 4 SH
EECE 7397 Advanced Machine Learning 4 SH
EECE 7398 Special Topics: Advances in Deep Learning 4 SH
EECE 7398 Special Topics: Bayesian Filtering and Tracking 4 SH
EECE 7398 Special Topics: Deep Learning for Embedded Systems 4 SH
EECE 7398 Special Topics: Distributed Intelligence 4 SH
EECE 7398 Special Topics: Flexible Robotics 4 SH
EECE 7398 Special Topics: Human Centered Computing
EECE 7398 Special Topics: Machine Learning with Small Data 4 SH
EECE 7398 Special Topics: Security in Large-Scaled Learning-Enabled Systems 4 SH
EECE 7399 Preparing High Stakes Written and Oral Materials 4 SH
   (only for PhD and MST students)
EECE 7400 Advanced Special Problems in ECE 1-4 SH
   (For PhD-AE students only)
CS 5100 Foundations of Artificial Intelligence 4 SH
CS 6200 Information Retrieval 4 SH
CS 6220 Data Mining Techniques 4 SH
CS 7800 Advanced Algorithms 4 SH
DS 5110 Introduction to Data Management and Processing 4 SH
DS 5983 Topics in Data Science 4 SH
MATH 7233 Graph Theory 4 SH

21.4. Electromagnetics, Plasma, and Optics (ELPO)

Fundamental Courses:
EECE 5693 Electromagnetic Devices for RF and Wireless Communications 4 SH
EECE 7202 Electromagnetic Theory 1 4 SH
EECE 7203 Complex Variable Theory and Differential Equations 4 SH
EECE 7275 Antennas and Radiation 4 SH

Concentration Courses:
EECE 5608 Magnetic Materials for Future Electronics 4 SH
EECE 5651 Introduction to Photonic Devices 4 SH
EECE 5652 Microwave Circuits and Networks 4 SH
EECE 5653 Introduction to Quantum Engineering 4 SH
EECE 5654 Design and Prototyping of Optical Systems 4 SH
EECE 5692 Antennas for Wireless Communication and Sensing 4 SH
EECE 5693 Electromagnetic Devices for RF and Wireless Communications 4 SH
EECE 5697 Acoustics and Sensing 4 SH
EECE 5698 Special Topics: Design & Prototyping of Optical Systems for Engineering Apps 4 SH
EECE 5698 Special Topics: Magnetic Materials and Devices for Microwave Engineering 4 SH
EECE 5698 Special Topics: Photonic Devices for Communication Systems 4 SH
EECE 5698 Special Topics: Quantum Hardware Platforms 4 SH
EECE 5698 Special Topics: Silicon Photonics 4 SH
EECE 5698 Special Topics: Superconducting Quantum Devices 4 SH
EECE 6400 Special Problems in ECE 1-4 SH
        (For MSECE and PhD-BS students only)
EECE 7105 Optics for Engineers 4 SH
EECE 7202 Electromagnetic Theory 1 4 SH
EECE 7203 Complex Variable Theory and Differential Equations 4 SH
EECE 7270 Electromagnetic Theory 2 4 SH
EECE 7271 Computational Methods in Electromagnetics 4 SH
EECE 7275 Antennas and Radiation 4 SH
EECE 7284 Optical Properties of Matter 4 SH
EECE 7293 Modern Imaging 4 SH
EECE 7296 Electronic Materials 4 SH
EECE 7398 Special Topics: Advanced Radio Frequency Passive Technologies 4 SH
EECE 7398 Special Topics: Multiphysics Simulation for Electronic, Acoustic, Photonic, and Magnet Devices 4 SH
EECE 7398 Special Topics: Photonic Circuit Design for Information Processing 4 SH
EECE 7399 Preparing High Stakes Written and Oral Materials 4 SH
        (only for PhD and MST students)
EECE 7400 Advanced Special Problems in Electrical and Computer Engineering 1-4 SH
        (only for PhD-AE students only)

21.5. Hardware and Software for Machine Intelligence (HSMI)

Fundamental Courses:
EECE 5644 Introduction to Machine Learning and Pattern Recognition 4 SH
EECE 7205 Fundamentals of Computer Engineering 4 SH
EECE 7352 Computer Architecture 4 SH
EECE 7353 VLSI Design 4 SH

Concentration Courses:
EECE 5512 Networked XR System 4 SH
EECE 5550 Mobile Robotics 4 SH
EECE 5552 Assistive Robotics 4 SH
EECE 5554 Robotics Sensing and Navigation 4 SH
EECE 5612 Statistical Inference: An Introduction for Engineers and Data Analysts 4 SH
EECE 5614 Reinforcement Learning and Decision Making under Uncertainty 4 SH
EECE 5639 Computer Vision 4 SH
EECE 5640 High-Performance Computing 4 SH
EECE 5641 Introduction to Software Security 4 SH
   (Students taking EECE 5641 can't receive credit for CY 5770)
EECE 5642 Data Visualization 4 SH
EECE 5643 Simulation and Performance Evaluation 4 SH
EECE 5644 Introduction to Machine Learning and Pattern Recognition 4 SH
EECE 5645 Parallel Processing for Data Analytics 4 SH
EECE 5668 Large Language Models 4 SH
EECE 5698 Special Topics: Cyber-Physical Security of IoT Systems in the Age of AI 4 SH
EECE 5698 Special Topics: Formal Methods for Dynamical Systems 4 SH
EECE 5698 Special Topics: Visual Sensing & Computing Co-Design Edge Machine Perception 4 SH
EECE 5699 Computer Hardware and System 4 SH
EECE 6400 Special Problems in ECE 1-4 SH
   (For MSECE and PhD-BS students only)
EECE 7150 Autonomous Field Robotics 4 SH
EECE 7204 Applied Probability and Stochastic Processes 4 SH
EECE 7205 Fundamentals of Computer Engineering 4 SH
EECE 7215 Introduction to Distributed Intelligence 4 SH
EECE 7268 Verifiable Machine Learning 4 SH
EECE 7323 Numerical Optimization Methods 4 SH
EECE 7337 Information Theory 4 SH
EECE 7345 Big Data and Sparsity in Control, Machine Learning, and Optimization 4 SH
EECE 7346 Probabilistic System Modeling and Analysis 4 SH
EECE 7352 Computer Architecture 4 SH
EECE 7353 VSLI Design 4 SH
EECE 7368 High-Level Design of Hardware-Software Systems 4 SH
EECE 7370 Advanced Computer Vision 4 SH
EECE 7390 Computer Hardware Security 4 SH
EECE 7393 Analysis and Design of Data Networks 4 SH
EECE 7397 Advanced Machine Learning 4 SH
EECE 7398 Special Topics: Advances in Deep Learning 4 SH
EECE 7398 Special Topics: Bayesian Filtering and Tracking 4 SH
EECE 7398 Special Topics: Deep Learning Embedded Systems 4 SH
EECE 7398 Special Topics: Flexible Robotics 4 SH
EECE 7398 Special Topics: Human Centered Computing 4 SH
EECE 7398 Special Topics: Legged Robotics 4 SH
EECE 7398 Special Topics: Machine Learning with Small Data
EECE 7400 Advanced Special Problems in ECE 1-4 SH
   (For PhD-AE students only)
IE 5360 Digital Manufacturing 4 SH
CS 5180 Reinforcement Learning and Sequential Decision Making 4 SH
CS 5335 Robotic Science and Systems 4 SH
CS 7340 Theory and Methods in Human Computer Interaction 4 SH
MATH 7233 Graph Theory 4 SH
PHIL 5010 AI Ethics 4 SH

21.6. Microsystems, Materials, and Devices (MSMD)

Fundamental Courses:
EECE 5606 Micro- and Nanofabrication 4 SH
EECE 7201 Solid State Devices 4 SH
EECE 7244 Introduction to Microelectromechanical Systems (MEMS) 4 SH
EECE 7353 VLSI Design 4 SH

Concentration Courses:
EECE 5161 Thin Film Technologies 4 SH
EECE 5606 Micro- and Nanofabrication 4 SH
EECE 5608 Magnetic Materials for Future Electronics 4 SH
EECE 5647 Nanophotonics 4 SH
EECE 5649 Design Analog Integrated Circuits Comp. Metal-Oxide-Semiconductor Tech 4 SH
EECE 5651 Introduction to Photonic Devices 4 SH
EECE 5652 Microwave Circuits and Networks 4 SH
EECE 5653 Introduction to Quantum Engineering 4 SH
EECE 5698 Special Topics: Biomedical Microsystems 4 SH
EECE 5698 Special Topics: Flexible and Printed Electronics 4 SH
EECE 5698 Special Topics: Introduction to Organic and Printed Electronics 4 SH
EECE 5698 Special Topics: Magnetic Materials and Devices for Microwave Engineering 4 SH
EECE 5698 Special Topics: Photonic Devices for Communication Systems 4 SH
EECE 5698 Special Topics: Quantum Hardware Platforms 4 SH
EECE 5698 Special Topics: Semiconductor Packaging 4 SH
EECE 5698 Special Topics: Silicon Photonics 4 SH
EECE 5698 Special Topics: Superconducting Quantum Devices 4 SH
EECE 5698 Special Topics: Visual Sensing & Computing Co-Design Edge Machine Perception 4 SH
EECE 6400 Special Problems in ECE 1-4 SH
     (For MSECE and PhD-BS students only)
EECE 7201 Solid State Devices 4 SH
EECE 7240 Analog Integrated Circuit Design 4 SH
     EECE 7248 Lab section for EECE 7240 0 SH
EECE 7244 Introduction to Microelectromechanical Systems (MEMS) 4 SH
EECE 7245 Microwave Circuit Design for Wireless Communication 4 SH
EECE 7247 Radio Frequency Integrated Circuit Design 4 SH
EECE 7250 Power Management Integrated Circuits 4 SH
EECE 7284 Optical Properties of Matter 4 SH
EECE 7296 Electronic Materials 4 SH
EECE 7353 VLSI Design 4 SH
EECE 7398 Special Topics: Advanced Radio Frequency Passive Technologies 4 SH
EECE 7398 Special Topics: Advances in Communication Electronics 4 SH
EECE 7398 Special Topics: Low Power Integrated Circuits Design 4 SH
EECE 7398 Special Topics: Multiphysics Simulation for Electronic, Acoustic, Photonic, and Magnet Devices 4 SH
EECE 7398 Special Topics: Photonic Circuit Design for Information Processing 4 SH
EECE 7399 Preparing High Stakes Written and Oral Materials 4 SH
     (only for PhD and MST students)
EECE 7400 Advanced Special Problems in ECE 1–4 SH
     (For PhD-AE students only)

21.7. Power Systems, Power Electronics, and Motion Control (POWR)

Fundamental Courses:
EECE 5680 Electric Drives 4 SH
EECE 5682 Power Systems Analysis 1 4 SH
EECE 5684 Power Electronics 4 SH
EECE 7200 Linear System Analysis 4 SH

Concentration Courses:
EECE 5580 Classical Control Systems 4 SH
EECE 5610 Digital Control Systems 4 SH
EECE 5670 Sustainable Energy: Materials, Conversion, Storage, and Usage 4 SH
EECE 5680 Electric Drives 1 4 SH
   EECE 5681 Lab for EECE 5680 0 SH
EECE 5682 Power Systems Analysis 1 4 SH
EECE 5684 Power Electronics 4 SH
   EECE 5685 Lab for EECE 5684 0 SH
EECE 5686 Electrical Machines 4 SH
EECE 5688 Analysis of Unbalanced Power Grids 4 SH
EECE 5690 Electric Vehicle Powertrains
EECE 5698 Special Topics: Electric Vehicles 4 SH
EECE 6400 Special Problems in ECE 1-4 SH
     (For MSECE and PhD-BS students only)
EECE 7200 Linear System Analysis 4 SH
EECE 7211 Nonlinear Control 4 SH
EECE 7213 System Identification and Adaptive Control 4 SH
EECE 7214 Optimal and Robust Control 4 SH
EECE 7224 Power System State Estimation 4 SH
EECE 7226 Modeling of Transients in Power Systems 4 SH
EECE 7228 Advanced Power Electronics 4 SH
EECE 7250 Power Management Integrated Circuits 4 SH
EECE 7323 Numerical Optimization Methods 4 SH
EECE 7398 Special Topics: Bayesian Filtering and Tracking 4 SH
EECE 7398 Special Topics: Power System Constrained Optimization 4 SH
EECE 7399 Preparing High Stakes Written and Oral Materials 4 SH
     (only for PhD and MST students)
EECE 7400 Advanced Special Problems in ECE 1-4 SH
     (For PhD-AE students only)

21.8.   Special Courses

EECE 7399 Preparing High Stakes Written and Oral Materials 4 SH

MSC students cannot register in this course as part of their degree course requirements. PhD and MST students can take this course as part of their course requirements. This course counts as concentration courses for MST and PhD-BE students. For PhD-AE students this course counts as one of their 4 course requirements after MS degree.

Only MSECE+LC students can take EECE 7440 and EECE 7442. They should coordinate with the Gordon Institute of Engineering Leadership.

21.9.   Excluded Courses for All Concentrations

Excluded courses are courses that you **cannot take as part of your MSECE program**. Please *do not* petition to take these courses, any petition to take these courses will be automatically rejected. PhD students can register in excluded courses, if their advisor recommends, but if they want to receive an MSECE degree on their way to PhD, they cannot count these courses as part of their MSECE course requirements.

1. The following classes of course are excluded:
2. Courses offered by the Multidisciplinary Graduate Engineering Programs (MGEN). These courses have one of the following prefixes INFO, DAMG, CSYE, TELE
3. Courses offered by the engineering leadership programs ALIGN courses in the Khoury College of Computer Sciences**
4. Certain CS course listed below:

> CS 5010 Programming Design Paradigm 4SH
> CS 5320 Digital Image Processing 4SH
> CS 5330 Pattern Recognition and Computer Vision 4SH
> CS 5340 Computer/Human Interaction 4SH
> CS 5520 Mobile Application Development 4SH
> CS 5610 Web Development 4SH
> CS 5700 Computer Networks 4SH
> CS 5800 Algorithms 4SH
> CS 6140 Machine Learning
> CS 6350 Empirical Research Methods 4SH
> CS 6710 Wireless Networks 4SH

**Excluded Courses do not apply to MSIoT, MSWiNE, MSAI, MSROBO, MSXR and MSSCEN

22. Master's of Science in Artificial Intelligence (MSAI)

Core Requirements:
EECE 5644 Machine Learning and Pattern Recognition 4 SH
   Or DADS 7275 Machine Learning and Data Analytics 4 SH
DS 5020 Introduction to Linear Algebra and Probability for Data Science 4 SH
   Or DADS 5200 Mathematics of Machine Learning 4 SH
CS 5130 Applied Programming and Data Processing for AI
CS 5100 Foundations of Artificial Intelligence 4 SH

Subset One Course List:
EECE 5550 Mobile Robotics 4 SH
EECE 5554 Robotics Sensing and Navigation 4 SH
EECE 5614 Reinforcement Learning and Decision Making Under Uncertainty 4 SH
EECE 5639 Computer Vision 4 SH
EECE 5642 Data Visualization 4 SH

Subset Two Course List:
EECE 5645 Parallel Processing for Data Analytics 4 SH
EECE 6400 Special Problems in Electrical and Computer Engineering 1-4 SH
EECE 7370 Advanced Computer Vision 4 SH
EECE 7397 Advanced Machine Learning 4 SH
EECE 7398 ST: Machine Learning with Small Data 4 SH

Capstone:
EECE 7945 Master's Project 4 SH

23. Master's of Science in Internet of Things (MSIoT)

Fundamental Courses:
EECE 5155 Wireless Sensor Networks and the Internet of Things 4 SH
Fundamental Options

Elective Course List:
EECE 5360 Combinatorial Optimization 4 SH
EECE 5512 Networked XR Systems 4 SH
EECE 5550 Mobile Robotics 4 SH
EECE 5554 Robotics Sensing and Navigation 4 SH
EECE 5578 Terahertz Communication 4 SH
EECE 5606 Micro- and Nanofabrication 4 SH
EECE 5639 Computer Vision 4 SH
EECE 5640 High-Performance Computing 4 SH
EECE 5641 Introduction to Software Security 4 SH
EECE 5642 Data Visualization 4 SH
EECE 5643 Simulation and Performance Evaluation 4 SH
EECE 5645 Parallel Processing for Data Analytics 4 SH
EECE 5649 Design of Analog Integrated Circuits with CMOS 4 SH
EECE 5652 Microwave Circuits and Networks 4 SH
EECE 5666 Digital Signal Processing 4 SH
EECE 5693 Electromagnetic Devices for RF and Wireless Communications 4 SH
EECE 5697 Acoustics and Sensing 4 SH
EECE 5698 ST: Advanced Network Management 4 SH
EECE 5698 ST: GNSS Signal Processing 4 SH
EECE 5698 ST: Network Programming 4 SH
EECE 5698 ST: Spectrum Policy issues for Wireless Communication Innovators 4 SH
EECE 5698 ST: Visual Sensing and Computing Co-Design for Edge Machine Perception 4 SH
EECE 5699 Computer Hardware and System Security
EECE 7150 Autonomous Field Robotics 4 SH
EECE 7200 Linear Systems Analysis 4 SH
EECE 7201 Solid State Devices 4 SH
EECE 7202 Electromagnetic Theory 1 4 SH
EECE 7204 Applied Probability and Stochastic Processes 4 SH
EECE 7205 Fundamentals of Computer Engineering 4 SH
EECE 7240 Analog Integrated Circuit Design 4 SH
EECE 7245 Microwave Circuit Design for Wireless Communication 4 SH
EECE 7247 Radio Frequency Integrated Circuit Design 4 SH
EECE 7275 Antennas and Radiation 4 SH
EECE 7310 Modern Signal Processing 4 SH
EECE 7323 Numerical Optimization Methods 4 SH
EECE 7336 Digital Communications 4 SH
EECE 7337 Information Theory 4 SH
EECE 7345 Big Data and Sparsity in Control, Machine Learning, and Optimization 4 SH
EECE 7346 Probabilistic System Modeling and Analysis 4 SH
EECE 7352 Computer Architecture 4 SH
EECE 7370 Advanced Computer Vision 4 SH
EECE 7374 Fundamentals of Computer Networks 4 SH
EECE 7390 Computer Hardware Security 4 SH
EECE 7397 Advanced Machine Learning 4 SH
EECE 7398 Special Topics: Advances in Communication Electronics 4 SH
EECE 7398 Special Topics: Advances in Deep Learning 4 SH
EECE 7398 Special Topics: Advances in Wireless Communications 4 SH
EECE 7398 Special Topics: An Experimental Approach to Wireless Communications 4 SH
EECE 7398 Special Topics: Deep Learning and Edge Computing in Wireless Networks 4 SH
EECE 7398 Special Topics: Security in Large-Scaled Learning-Enabled Systems 4 SH
EECE 7398 Special Topics: Wireless Network Systems and Applications 4 SH

24. Master's of Science in Wireless and Network Engineering (MSWiNE)

Fundamental Courses:
EECE 5576 Wireless Communication Systems 4 SH
EECE 7364 Mobile and Wireless Networking 4 SH
EECE 7374 Fundamentals of Computer Networks 4 SH

Elective Course List:
EECE 5155 Wireless Sensor Networks and the Internet of Things 4 SH
EECE 5360 Combinatorial Optimization 4 SH
EECE 5512 Networked XR Systems 4 SH
EECE 5578 Terahertz Communication 4 SH
EECE 5610 Digital Control Systems 4 SH
EECE 5612 Statistical Inference: An Introduction for Engineers and Data Analysts 4 SH
EECE 5640 High-Performance Computing 4 SH
EECE 5641 Introduction to Software Security 4 SH
EECE 5643 Simulation and Performance Evaluation 4 SH
EECE 5644 Introduction to Machine Learning and Pattern Recognition 4 SH
EECE 5645 Parallel Processing for Data Analytics 4 SH
EECE 5666 Digital Signal Processing 4 SH
EECE 5693 Electromagnetic Devices for RF and Wireless Communications 4 SH
EECE 5697 Acoustics and Sensing 4 SH
EECE 5698 ST: Advanced Network Management 4 SH
EECE 5698 ST: GNSS Signal Processing 4 SH
EECE 5698 ST: Introduction to Legal Aspects in Electrical and Computer Engineering 4 SH
EECE 5698 ST: Network Programming 4 SH
EECE 5698 ST: Spectrum Policy Issues for Wireless Communications Innovators 4 SH
EECE 5699 Computer Hardware and System Security 4 SH
EECE 6400 Special Problems in ECE 4 SH
   (For MS and PhD-BS students only)
EECE 7200 Linear Systems Analysis 4 SH
EECE 7202 Electromagnetic Theory 1 4 SH
EECE 7204 Applied Probability and Stochastic Processes 4 SH
EECE 7205 Fundamentals of Computer Engineering 4 SH
EECE 7245 Microwave Circuit Design for Wireless Communication 4 SH
EECE 7247 Radio Frequency Integrated Circuit Design 4 SH
EECE 7275 Antennas and Radiation 4 SH
EECE 7336 Digital Communications 4 SH
EECE 7337 Information Theory 4 SH
EECE 7345 Big Data and Sparsity in Control, Machine Learning, and Optimization 4 SH
EECE 7352 Computer Architecture 4 SH
EECE 7393 Analysis and Design of Data Networks 4 SH
EECE 7398 ST: Advances in Communication Electronics 4 SH
EECE 7398 ST: Advances in Wireless Communications 4 SH
EECE 7398 ST: An Experimental Approach to Wireless Communications 4 SH
EECE 7398 ST: Deep Learning and Edge Computing in Wireless Networks 4 SH
EECE 7398 ST: Security in Large-Scaled Learning-Enabled Systems 4SH
EECE 7398 ST: Wireless Network Systems and Applications 4 SH
EECE 7399 Preparing for High Stakes Written and Oral Materials 4 SH
   (Only for PhD and MST)
EECE 7400 Advanced Special Problems in Electrical and Computer Engineering 4 SH
   (For PhD-AE students only)

25. Master's of Science in Semiconductor Engineering (MSSCEN)

Core Requirements

NanoSystems:

EECE 7201 Solid State Devices 4 SH

EECE 7240 Analog Integrated Circuit Design 4 SH

      EECE 7248 Lab for EECE 7240 0 SH

EECE 7244 Introduction to Microelectromechanical Systems (MEMS) 4 SH

   Or ME 6260 Introduction to Microelectromechanical Systems (MEMS) 4 SH

Manufacturing:

EECE 5606 Micro- and Nanofabrication 4 SH

MATL 7365 Properties and Processing of Electronic Material 4 SH

ME 5630 Nano- and Microscale Manufacturing 4 SH

Innovation:

BUSN 6379 Entrepreneurial Ecosystems 4 SH

BUSN 6389 Leading Global Virtual Innovation Teams 4 SH

CHME 5976 Directed Study 1-4 SH

GE 5010 Customer-Driven Technical Innovation for Engineers 4 SH

GE 5100 Product Development for Engineers 4 SH

INNO 6200 Enterprise Growth and Innovation 4 SH

ME 5976 Directed Study 1-4 SH

EECE 6400 Special Problems in ECE 1-4 SH

Concentration Courses

EECE 5606 Micro- and Nanofabrication 4 SH

EECE 5651 Introduction to Photonic Devices 4 SH

EECE 7201 Solid State Devices 4 SH

EECE 7240 Analog Integrated Circuit Design 4 SH

      EECE 7248 Lab for EECE 7240 0 SH

EECE 7244 Introduction to Microelectromechanical Systems (MEMS) 4 SH

   Or ME 6260 Introduction to Microelectromechanical Systems (MEMS) 4 SH

EECE 7250 Power Management Integrated Circuits 4 SH

EECE 7353 VLSI Design 4 SH

Restricted Elective List - Other courses available here:

EECE 5606 Micro- and Nanofabrication 4 SH

EECE 5651 Introduction to Photonic Devices 4 SH

EECE 5612 Statistical Inference: An Introduction for Engineers and Data Analysts 4 SH

EECE 5644 Introduction to Machine Learning and Pattern Recognition 4 SH

EECE 5647 Nanophotonics 4 SH

EECE 5649 Design of Analog Integrated Circuits & Complementary Metal-Oxide-Semiconductor Tech 4 SH

EECE 5651 Introduction to Photonic Devices 4 SH

EECE 5652 Microwave Circuits and Systems 4 SH

EECE 5653 Introduction to Quantum Engineering 4 SH

EECE 5698 Special Topics: Biomedical Microsystems 4 SH

EECE 7201 Solid State Devices 4 SH

EECE 7240 Analog Integrated Circuit Design 4 SH

      EECE 7248 Lab for EECE 7240 0 SH

EECE 7244 Introduction to Microelectromechanical Systems (MEMS) 4 SH

   Or ME 6260 Introduction to Microelectromechanical Systems (MEMS) 4 SH

EECE 7245 Microwave Circuit Design for Wireless Communication 4 SH

EECE 7247 Radio Frequency Integrated Circuit Design 4 SH

EECE 7250 Power Management Integrated Circuits 4 SH

EECE 7296 Electronic Materials 4 SH

EECE 7353 VLSI Design 4 SH

EECE 7368 High-Level Design of Hardware-Software Systems 4 SH

EECE 7398 Advanced Special Topics: Advanced Radio Frequency Passive Technology 4 SH

EECE 7387 Advanced Special Topics: Low Power Integrated Circuits Design 4 SH

26. Grading Guide for Special Graduate Courses

These courses require registration override signed by the instructor/advisor

Course #	Course Title	Credits	Grading	Comments
EECE 6400*	Special Problems ECE	4 SH	A to C- or F	Can be taken once as a MSECE or PhD-BE student.
EECE 7400*	Special Problems ECE	4 SH	A to C− or F	Can only be taken once as a PhD-AE student.
EECE 7945*	Master's Project	4 SH	A to C− or F	Can only be taken once in MSECE program or as the first part of MST.
EECE 7990*	Master's Thesis	4 SH	A to C− or F	Can only be taken once. Second part of MST track.
EECE 7996* (can only be taken once)	Master's Thesis Continuation	0 SH	S/U (satisfactory or unsatisfactory)	For students who, after completion of EECE 7945 and EECE 7990, have not yet defended their MS thesis. Does NOT maintain FT status – PT* status
EECE 8986**	(MS) Research	0 SH	S/U	For MSECE students who, after taking EECE 7945, or/and EECE 7990, have not yet finished their project/thesis. Maintains FT** status
EECE 9986**	(PhD) Research	0 SH	S/U	For PhD students who have not passed the qualifying exam but want to do research. Also, PhD students who commence the program in summer semester. Maintains FT** status
EECE 9990** EECE 9991**	Dissertation Term 1 Dissertation Term 2	0 SH	S/U	Taken in two consecutive semesters after passing the Qualifying Exam. Maintains FT** status
EECE 9996**	Dissertation Continuation	0 SH	S/U	For PhD students that after completion of EECE 9990 and EECE 9991 who have not yet defended their dissertation. This course Maintains FT** status.

Please note the following:

- During internship students must be enrolled in one of the following courses:

    - ENGR 9700 – Full-time Internship, 0 SH, FT** Equivalent

    - ENGR 9702 – Part-time Internship, 0 SH, PT* Equivalent + 4 SH course or one of the following:

        - EECE 9986 – Research – 0 SH, FT** Equivalent
        - EECE 9990 – Dissertation 1 - 0 SH, FT** Equivalent
        - EECE 9991 – Dissertation 2 - 0 SH, FT** Equivalent
        - EECE 9996 – Dissertation Continuation - 0 SH, FT** Equivalent

    - To register for an ENGR, the student must connect with coe-phd-gradadvising@northeastern.edu

- Students on Co-op must be enrolled in:
    - EECE 6964 – Coop Work Experience, 0 SH, FT** Equivalent
    - EECE 6954 – Coop Work Experience, 0 SH, PT* Equivalent

- During the summer terms, registration in these courses is for Full Summer not Summer 1 or 2.

- Continuing PhD students who have passed EECE 9991 (PhD Dissertation Term-2) must be registered in EECE 9996 (PhD Dissertation Continuation, 0 SH, FT Equivalent) in all fall and spring semesters until they graduate. They do not need to register in this course in summer unless they are graduating in August. If they are graduating in August, they must register in this course for the entire summer semester.

   (*) For these courses, if a section under advisor's name exists, the student can register by filing an override form and obtaining instructor/advisor's signature. If a section of this course under the name of the advisor/instructor does not exist, the student should complete a Registration Override Form found here, to request generation of a section or reach out to the Program Contact. Courses with * taken alone, do not give the student FT status. The course should be taken in combination with another course to achieve 8 SH for the given semester.

   (**) Registration in this course is equivalent to full-time registration.

27. Course Registration Frequently Asked Questions

If you encounter an issue during course registration, this section may contain a solution for you. If you still have questions, please contact the Assistant Director of Graduate Programs (p.krafka@northeastern.edu)

Q: I received a registration error.

A: Please complete a Registration Override Request. Be sure to include your transcripts to the request.

Q: I received a "College" error when registering for a CS or CY course.

A: Khoury students are given priority to these courses, just as ECE students are given priority to EECE courses. You will need to fill out the Khoury Elective Form for these courses.

Q: I need to register for a MS Project, MS Thesis, or Research course.

A: Please fill out an Override Request Form. This will give the student access to register and inform the Program Contact to create a section if needed.

Q: I have questions regarding tuition, financial aid, or financial holds.

A: Please contact Student Financial Services: sfs@northeastern.edu

Q: Can I audit a course?

A: The short answer is yes, although ultimately, it is up to the instructor. You can download an audit form from the Registrar's website, have the instructor sign off if they approve, and then you can bring it directly to the Registrar. Please note that auditing courses is permitted in the Fall and Spring semesters, but not in the summer.

28. Useful Links

- General Information Links
  - [Academic Integrity Policies](#)
  - [Code of Student Conduct](#)
  - [COE Coop Eligibility Page](#)
  - [COE Policies and Procedures](#)
  - [COE Probation Policies](#)
  - [Course Descriptions](#)
  - [ECE Department website](#)
  - [ECE Graduate Studies website](#)
  - [Gordon Leadership Program](#)
  - [Graduate School of Engineering](#)
  - [NU Graduate Catalog](#)
  - [NU Graduate Student Government](#)
  - [Official University Academic Calendars](#)
  - [Registrar's Office](#)
  - [University Health and Counseling Services](#)
  - [Office of Global Services (OGS)](#)

- Links to Forms
  1. [Announcement form for MS Thesis Defense, PhD Proposal Review, or Dissertation Defense](#)
  2. [Change in Degree Program/Concentration](#)
  3. [Change in Degree Level](#)
  4. [COE Forms (petition, registration override, ...)](#)
  5. [PhD Dissertation Proposal Review Form](#)
  6. [PhD Proposal Review Approval Form - Submission Link](#)
  7. [Individual Instruction Registration Request](#)
  8. [LATEX templates for MS thesis and PhD Dissertation](#)
  9. [PhD Annual Review Form](#)
  10. [PhD Committee Form](#)
  11. [PhD Committee Form – Submission Link](#)
  12. [PhD Research Advisor Form](#)
  13. [PhD Research Advisor Form- Submission Link](#)
  14. [Qualifying Exam Proposal Form](#)
  15. [Various ECE Forms](#)