

# **Graduate Program Guide**

**Department of Electrical and Computer Engineering**

**Northeastern University**

**Academic Year 2016-17**

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## **Acronyms**

**CCSP:** Communications, Control, and Signal Processing

**CMPE:** Computer Engineering

**CNWS:** Computer Networks and Security

**COE:** College of Engineering

**CSYS:** Computer Systems and Software

**CVLA:** Computer Vision, Machine Learning, and Algorithms

**DF:** Dean's Fellow(ship)

**DDF:** Distinguished Dean's Fellow(ship)

**ECE:** Electrical and Computer Engineering

**ELPO:** Electromagnetics, Plasma, and Optics

**FT:** Full-time

**GAC:** Graduate Affairs Committee

**GSE:** Graduate School of Engineering

**IP:** In Progress

**ISSI:** International Students and Scholars Institute (now OGS)

**MSC:** MSECE, course-only track

**MSECE:** Master of Science in Electrical and Computer Engineering

**MSMD:** Microsystems, materials, and devices

**MST:** MSECE, course-thesis track

**NU:** Northeastern University

**NUID:** Northeastern University Identification Number

**OGS:** Office of Global Services (formerly ISSI)

**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)

**SH:** Semester Hour

**S/U:** Satisfactory or Unsatisfactory

# 1 General Information

This document provides information about the graduate program at the ECE Department, Northeastern University. Graduate students are expected to read this document, be familiar with the rules and regulations, and refer to it when they have questions about the program.

## 1.1 Graduate Programs and Degrees

The ECE Department offers three main graduate programs, Master of Science in Electrical and Computer Engineering (MSECE), PhD in Electrical Engineering (PhDEE), and PhD in Computer Engineering (PhDCE). All programs can be pursued full-time or part-time (FT or PT). Applicants with a BS or MS degree in electrical engineering, or a closely related field, can apply either to the MSECE or one of the PhD programs. In other words, to apply to the PhD programs it is not required to hold an MS degree. In addition to these programs, the department offers two other programs in cooperation with the Gordon Institute of Engineering Leadership. These programs are Master of Science in Electrical and Computer Engineering Leadership (MSECEL) and MSECE with leadership certificate. MSECE with leadership certificate has the same requirements of MSECE plus additional course and projects as determined by the Gordon Institute of Engineering Leadership. The requirements of MSECEL are different and will be later described in Section 5.

## 1.2 MSECE Tracks

MSECE applicants, at the time they apply to the program, select one of the two tracks: the course-thesis track (MST), or the course-only track (MSC). Applicants who apply to the MST program will also be considered for admission to the MSC program. Applicants to the PhD program, who are not admitted to PhD, will be automatically considered for MSECE admission. Changing tracks is possible *after finishing one semester in the original track*. Please refer to Section 14 for details, conditions, and requirements.

## 1.3 MSECE Concentrations

Starting with spring 2016, MSECE applicants select one of the seven concentrations of study at the time they apply for admission. These concentrations are:

1. Communications, Control, and Signal Processing (CCSP)
2. Computer Networks and Security (CNWS)
3. Computer Systems and Software (CSYS)
4. Computer Vision, Machine Learning, and Algorithms (CVLA)
5. Electromagnetics, Plasma, and Optics (ELPO)
6. Microsystems, Materials, and Devices (MSMD)
7. Power Systems, Power Electronics, and Motion Control (POWR)

Before spring 2016, the three new concentrations CNWS, CSYS, and CVLA, were one concentration — Computer Engineering (CMPE). During spring 2016, the CMPE students had the opportunity to either change to one of the three concentrations or remain in CMPE. The CMPE concentration will continue to exist at the PhD level. At the MSEE level, no new students will be admitted in this concentration and this concentration will be substituted by the three new concentrations of CNWS, CSYS, and CVLA.

Change of concentration is possible *after finishing one semester in the original concentration*. This is done by filing a petition. Only a fraction of petitions for changing concentration are approved. Details can be found in Sections [14](#) and [10](#).

## 1.4 Description of ECE Concentrations

**Communication, Control, and Signal Processing (CCSP)** This concentration focuses on 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 and machine learning; robust, adaptive, and distributed control; image and video processing, mobile and assistive robotics; detection, estimation 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, synthesis, compilers, computer arithmetic, resilient computation, advanced logic design, operating systems, power/performance analysis, hardware/software co-design.

**Computer Networks and Security (CNWS)** The Computer Networks and Security concentration prepares students for careers in a wide range of areas including wired/wireless network analysis and protocol design, sensor network design, and software and hardware security. Coursework includes network fundamentals, wireless communications, mobile and wireless networks, computer hardware security and computer software security. Students will learn the proper design and evaluation of wired/wireless networks, TCP/IP, Internet and OSI models, popular Internet applications (HTTP, SMTP, etc.), defensive and offensive approaches to cybersecurity, malware/attack analysis and remediation, side-channel leakage, and hardware/software hardening.

**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.

**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 as well as 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.



## 1.5 PhD Concentrations

PhD students can enter the PhD program either with a BS degree or with a Master's degree.

**1) PhD students entering the program with a BS degree (PhD: BS entry):** PhDC students need to first complete Master's degree requirements in one of the three concentrations of CNWS, CSYS, or CVLA. 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, PhDC students will be collectively in the CMPE concentration and PhDEE students continue to be in the concentration in which they finished their Master's. For details of the requirements for these students see Section 6.

**2) PhD students entering the program with a Master's degree (PhD: Advanced entry):** PhDC students will be in the CMPE concentration and PhDEE students will be in one of the four concentrations of CCSP, ELPO, MSMD, or POWR. For details of the requirements for these students see Section 7.

Change of concentration and program (from PhDC 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 14.

## 1.6 Graduate Advising

Students who are supported by Research Assistantship (RA), Dean's Fellowship (DF), and Distinguished Dean's Fellowships (DDF), are academically advised by their research advisor (i.e., the supporting faculty).

MSC students, and PhD and MST students who do not yet have a research advisor, will be advised on rules and regulations by Faith Crisley, the student services coordinator of the ECE department ([f.crisley@neu.edu](mailto:f.crisley@neu.edu)), or Matthew Podgurski, the student services specialist in the GSE ([m.podgurski@neu.edu](mailto:m.podgurski@neu.edu)). If needed, they will be referred to the appropriate faculty for advice on course content.

As soon as PhD or MST students have the agreement of a faculty member to serve as their research advisor, they complete and submit the **PhD Research Advisor Form**. After submission of this form their research advisor will also serve as their academic advisor.

## 2 The ECE Graduate Curriculum

It is essential to know the meaning of **DEPTH**, **BREADTH**, and **EXCLUDED** courses in the graduate curriculum. These notions are only relevant to MSECE students and also to those PhD students who enter the program with a BS degree (PhD, BS entry) while they are completing the MSECE requirements.

### 2.1 Depth Courses

These courses provide depth of knowledge in one of the seven MSECE concentrations. Depth courses depend on concentration and are listed under "Depth Courses" for each concentration (see pages 27-30). Some courses are listed as depth course for multiple concentrations.

Depth courses can be ECE or non-ECE courses (for instance, a number of CS and MATH courses are listed under CNWS, CSYS, and CVLA as “Depth Courses”).

In order to register in a depth courses *no petition is required*; this applies to both ECE and non-ECE depth courses. Please note that in some older documents “Depth Courses” are referred to as “Approved Concentration Courses”; there is no difference between these two names.

## 2.2 Breadth Courses

These courses are required to provide knowledge in areas besides student’s concentration. Any graduate-level course **that is not a depth course for a student’s concentration** (i.e., is not listed under the “Depth Courses” of *his/her concentration*) can be a *potential* “Breadth Course”. Note that breadth courses are meant to provide knowledge in areas other than your concentration. **Therefore, course that are depth for your concentration, or courses from other departments with content close to your concentration cannot be taken as breadth.**

There are three categories of breadth courses:

- 1) **Courses which are not listed as depth course for a student’s concentration but are listed as a depth course for another concentration:** These can be ECE or non-ECE courses. These courses can be always taken as breadth and registering in them *does not require a petition*.
- 2) **Non-ECE graduate courses that are not depth for any ECE concentration:** These are usually graduate courses in a department closely related to ECE. Registration in these courses *requires filing a petition, and getting its approval, before registration in the course*. Petitions will be approved only for courses that are distinct enough from student’s concentration. The details of how to file a petition are explained in Section 10.
- 3) **ECE graduate courses that are not depth for any ECE concentration:** There is currently only one such course, EECE 7399: Preparing High Stakes Written and Oral Materials, registration in this course *does not* require a petition.

Putting it another way, the following categories of courses can be taken as “breadth courses”:

1. Any graduate-level ECE course *that is not depth for your concentration*.  
For these courses you *do not* need a petition.
2. Any non-ECE course that is depth for *another* ECE concentration (and is not depth for *your* concentration).  
For these courses you *do not* need a petition.
3. Other graduate-level non-ECE courses *only if they are approved*.  
To register in these courses you need to file a petition. You can register in the course *after* your petition is approved.
4. You *cannot* take excluded courses as breadth. For definition of excluded courses see below and for their list see Section 15.10.

## 2.3 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 15.10 for the list of excluded courses.

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

Please use the following checklist for successful progress towards MSECE (course-only track):

- Step 1** Make sure that you read this document thoroughly and understand all of it. Plan a program of study for your degree based on depth and breadth requirements as explained below. When in doubt, contact Faith Crisley at [f.crisley@neu.edu](mailto:f.crisley@neu.edu) or Matthew Podgurski at [m.podgurski@neu.edu](mailto:m.podgurski@neu.edu). Make sure that in your plan of study all prerequisites are taken before the time you plan to register in a course (for course description and pre-requisites see [here](#)). You need to complete **32 SH of graduate-level course work** to graduate. The details are given below.
- Step 2** **Depth Requirements:** Refer to the list of “Depth Courses” for *your concentration* on pages [27-30](#)). You need to take and successfully complete **at least five** “Depth Courses” (20 SH).
- Step 3** **Breadth Requirements:** Graduate level courses outside your “Depth Courses”, whether in ECE or in a closely related department, can be potentially taken as “Breadth Courses”. You need to complete **at least two** “Breadth Courses” (8 SH) to graduate.
- Note 1** If you plan to take a non-ECE breadth course that is *not* on the list of “Depth Courses” of a concentration different from yours, you need to file a petition *before registration in the course*. See Section [10](#) 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 petition to take these courses. Such petitions are automatically rejected. See Section [15.10](#) for the list of excluded courses.
- Note 3** Courses that are listed under depth courses for your concentration cannot be taken as breadth courses, even if they are listed as depth course for another concentration.
- Note 4** For CCSP, ELPO, MSMD, and POWR students, the total number of non-ECE courses, *whether they are depth or breadth*, cannot exceed two courses (8 SH). CMPE, CNWS, CSYS, and CVLA students can take up to three non-ECE courses (12 SH).
- Note 5** If you want to register in a CS class, you need to fill in a form at [CCIS course registration form](#). College of Computer and Information Science (CCISS) courses are open only to their own concentrations/degrees during the initial preregistration period.
- Note 6** You may register for EECE7400 (Special Problems in ECE, 1-4 SH) for *at most* 4 SH in your MSECE program. Registration in this course requires filing a registration override form (see Section [10](#)).
- Note 7** A maximum of 9 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 [10](#) on how to file a petition). You need to have a grade of at least B in transfer courses. Courses that have been previously counted towards obtaining a degree cannot be transferred. For more details see Section [13](#).

**Note 8** You graduate when you have successfully passed 32 SH of courses and have fulfilled the requirements as described above. To graduate you must have a cumulative GPA of at least 3.00 with no more than 8 semester hours of grades below B– in all courses applied to the degree.

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

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

- Step 1** Make sure that you read this document thoroughly and understand all of it. Plan a program of study for your degree based on depth and breadth requirements as explained below. When in doubt, if you have a research advisor, consult with him/her. If you do not yet have a research advisor contact Faith Crisley at [f.crisley@neu.edu](mailto:f.crisley@neu.edu) or Matthew Podgurski at [m.podgurski@neu.edu](mailto:m.podgurski@neu.edu). Make sure that in your plan of study all prerequisites are taken before the time you plan to register in a course (for course description and pre-requisites see [here](#)). You need to complete **24 SH of graduate-level course work plus 8 SH of thesis** to graduate. The details are given below.
- Step 2** Talk to the ECE faculty about their research interests and find a research advisor whose research matches your interests and background. Your research advisor can be any tenured, tenure-track, affiliated, or adjunct ECE faculty. A list of ECE faculty can be found on the ECE website. After finding a research advisor, he/she will be your academic advisor as well. The deadline for finding a research advisor is *one year after your matriculation* at NEU. 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 14.
- Step 3** **Depth Requirements:** Refer to the list of “Depth Courses” for *your concentration* on pages 27-30). You need to take and successfully complete **at least three** “Depth Courses” (12 SH).
- Step 4** **Breadth Requirements:** Graduate level courses outside your “Depth Courses”, whether in ECE or in a closely related department, can be taken as “Breadth Courses”. You need to complete **at least one** “Breadth Course” (4 SH).
- Note 1** If you plan to take a non-ECE breadth course that is *not* on the list of “Depth Courses” of one of the ECE concentration, you need to file a petition *before registration in the course*. See Section 10 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 petition to take these courses. Such petitions are automatically rejected. See Section 15.10 for the list of excluded courses.
- Note 3** Courses that are listed under depth courses for your concentration cannot be taken as breadth courses, even if they are listed as depth course for another concentration.
- Note 4** The total number of non-ECE courses that you can take, *whether they are depth or breadth courses*, cannot be more than three courses (12 SH). This applies to all concentrations.

- Note 5** If you want to register in a CS class, you need to fill in a form at [CCIS course registration form](#). College of Computer and Information Science (CCISS) courses are open only to their own concentrations/degrees during the initial preregistration period.
- Note 6** You may register for EECE7400 (Special Problems in ECE, 1–4 SH) for *at most* 4 SH in your MSECE program. Registration in this course requires filing a registration override form (see Section 10).
- Note 7** A maximum of 9 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 10 on how to file a petition). You need to have a grade of at least B in transfer courses. Courses that have been previously counted towards obtaining a degree cannot be transferred. For more details see Section 13.

**Step 5** **Thesis Requirements:** You need to register for 8 SH in EECE 7990 (Master’s Thesis). This is usually done in two semesters, each semester 4 SH, but can also be done in one semester for 8 SH.

- Note 1** If after taking 8 SH of EECE 7990 (Master’s Thesis), you have not yet successfully defended your thesis, you need to register each semester in EECE 7996 (Master’s Thesis Continuation, 0 SH) until you successfully defend your thesis.
- Note 2** When you are ready to defend your thesis, you need to form a “Thesis Committee” in consultation with your advisor. The Committee must have at least three members, and at least two of the members must be tenured or tenure-track ECE faculty. After successful defense of 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 date of defense. The MS thesis announcement form can be found [here](#).
- Note 3**  $\LaTeX$  templates for writing MS thesis can be found [here](#).

**Step 6** You graduate when you have successfully defended your thesis and fulfilled your course requirements. To graduate you must have a cumulative GPA of at least 3.00 with no more than 8 semester hours of grades below B– in all courses applied to the degree.

## 5 Checklist for MSECEL Students

Please use the following checklist for successful progress towards MSECEL:

**Step 1** Make sure that you read this document thoroughly and understand all of it. In consultation with your GL advisor, plan a program of study for your degree based on depth and breadth requirements as explained below. When in doubt, contact your Gordon Leadership (GL) advisor or Faith Crisley ([f.crisley@neu.edu](mailto:f.crisley@neu.edu)). Make sure that in your plan of study all prerequisites are taken before the time you plan to register in a course (for course description and pre-requisites see [here](#)). You need to complete **16 SH of graduate-level course work** plus 16 SH of GL courses, as advised by your GL advisor, to graduate.

The details for the ECE courses are given below. For GL courses and requirement please consult your GL advisor.

**Step 2** **Depth Requirements:** You have to select, in consultation with your GL advisor, one of the seven ECE concentrations. Refer to the list of “Depth Courses” for *your concentration* on pages 27–30. You need to take and successfully complete **at least two** “Depth Courses” (8 SH). The remaining two courses (8 SH) can be depth or breadth courses.

**Note 1** If you plan to take a non-ECE breadth course that is *not* a depth course for any ECE concentration, you need to file a petition *before registration in the course*. See Section 10 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 petition to take these courses. Such petitions are automatically rejected. See Section 15.10 for the list of excluded courses.

**Note 3** Regardless of your concentration, from the 16 SH non GL courses that you must take, at least 12 SH must be ECE courses.

**Note 4** If you want to register in a CS class, you need to fill in a form at [CCIS course registration form](#). College of Computer and Information Science (CCISS) courses are open only to their own concentrations/degrees during the initial preregistration period.

**Note 5** You graduate when you have successfully passed 16 SH of ECE graduate courses and have fulfilled the requirements of the GL program. To graduate you must have a cumulative GPA of at least 3.00 with no more than 8 semester hours of grades below B– in all courses applied to the degree.

## 6 Checklist for PhD Students with MS Degree (PhD, Advanced entry)

**Step 1** If you have a research advisor, he/she will be your academic advisor as well. If you do not yet have a research advisor, you will be advised by Faith Crisley at [f.crisley@neu.edu](mailto:f.crisley@neu.edu) until you have found a research advisor. It is essential that you meet your academic advisor *prior to the registration period for each semester* and review your course selection with him/her.

**Step 2** Plan a program of study for your degree *in consultation with your academic advisor*. Make sure that all prerequisites are taken before the time you plan to register in a course (for course description and pre-requisites see [here](#)).

**Step 3** If you do not already have a research advisor, talk to the ECE faculty about their research interests and find a research advisor whose research matches your interests and background. Your research advisor can be any tenured, tenure-track, affiliated, or adjunct ECE faculty. A list of ECE faculty can be found on the ECE website. After finding a research advisor, complete and submit the research advisor form found [here](#). Your research advisor will serve as your academic advisor. The deadline for finding a research advisor is *one year after your matriculation* at NEU. For details see Section 8.

**Step 4**     **Course Requirements:** You need to complete at least 16 SH of graduate level course work beyond Master's degree.

**Note 1**     Typically, students take more than 16 SH; usually 24 SH or more.

**Note 2**     Courses are selected in consultation with your research advisor.

**Note 3**     At least 8 SH of your courses must be graduate-level ECE courses.

**Note 4**     If you plan to register in a non-ECE course that is *not* on the list of "Depth Courses" of any ECE concentration, you need to file a petition *before registration in the course*. Please see Section 10 on how to file a petition.

**Note 5**     You may register for EECE7400 (Special Problems in ECE, 1-4 SH) for *at most* 4 SH in your PhD program. Registration in this course requires filing a petition and a registration override form (see Section 10).

**Note 6**     A maximum of 9 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 10). 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.

**Note 7**     To graduate you must have a cumulative GPA of at least 3.00 with no more than 8 semester hours of grades below B- in all courses applied to the degree.

**Step 5**     **Qualifying Exam:** The ECE qualifying exam is administered once a year during the spring semester in five areas of CCSP, CMPE, ELPO, MSMD, and POWR. You have to register for and take the qualifying exam in the spring of your first year at Northeastern. If you start your program in the spring semester, or if you are a part-time student, you can postpone the exam until the next spring. Failure to taking the qualifying exam at the time you are supposed to take it *is equivalent to failure in the exam*. For details see Section 8.

**Note 1**     PhDCE students take the qualifying exam in CMPE, PhDEE students can take the exam in any of the other four concentrations based on their advisor's recommendation.

**Note 2**     If you do not pass the qualifying exam in your first attempt, you have to retake it the next spring. This will be your last chance to pass the qualifying exam.

**Note 3**     The outcome of the qualifying exam can be "pass", "fail", or "conditional pass". In this latter case, certain conditions are set to be fulfilled to achieve full pass.

**Note 4**     After passing the qualifying exam (full passing, or completing all conditions if passed conditionally), your status changes from "Predoctoral Student" to "PhD Candidate".

**Note 5**     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 filing a registration override form (see Section 10). PhD students who start the program in summer also register in this course.

**Step 6** You must register in EECE 9990 (Dissertation, 0 SH) for *two consecutive semesters immediately after achieving PhD candidacy*.

**Note** If after two consecutive semesters of taking EECE 9990 you have not yet defended your dissertation (this is very typical), you must register in EECE 9996 (Dissertation Continuation, 0SH) in each fall and spring semester until you successfully defend your dissertation. During the summer semester you are not required to register in EECE 9996, unless you are graduating at the end of that summer (August graduation). If you are graduating in August you **must be registered** in EECE 9996 *for the entire summer semester*.

**Step 7** **PhD Committee:** You should form your “PhD Committee” in consultation with your advisor, not later than the last day of the spring semester following the spring in which you passed the qualifying exam. For instance if you passed the qualifying exam (fully or conditionally) in spring semester 2016, you have until the last day of spring semester 2017 to form your Committee. For part-time students this deadline is the last day of the second spring after passing the qualifying exam. This Committee must have at least three members of which at least two must be tenured or tenure-track ECE faculty. After forming the Committee you fill in the [PhD Committee Form](#) and submit it. For details, see Section 8.

**Step 8** **Dissertation Proposal Review (previously known as “Comprehensive Exam” or “Proposal Defense”):** 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 passed the 16 SH course requirements after MS, have taken two semesters of EECE 9990, and have formed your PhD Committee. It is recommended that the Dissertation Proposal Review be scheduled within two years after passing the qualifying exam. To announce your PhD proposal review please complete and submit the [proposal review announcement form](#). After successful defense of the proposal, you completes the [Dissertation Proposal Review Form](#). This form is signed by your advisor and PhD committee members and is filed with Faith Crisley, the student services coordinator. If the proposal review is not successful, the Committee submits written recommendations on the direction of the research and arranges a date for future review. For details, see Section 8.

**Note 1** The Dissertation Proposal Review consists of a presentation of your research proposal followed by a question/answer session by your PhD Committee. The presentation part of this exam is open to faculty and students.

**Note 2** Before the review, you should download the “Dissertation Proposal Review Form” from [here](#) and complete it. After the exam, this form is signed by the PhD Committee members. You should then scan the form and save it as a pdf file and email it to Faith Crisley at [f.crisley@neu.edu](mailto:f.crisley@neu.edu) with subject “Dissertation Proposal Review form from XXX ID number YYY”, where XXX is your complete name and YYY is your NUID.

**Step 9** **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. The dissertation defense must be scheduled not sooner than six months after the date of the dissertation proposal review. To announce your PhD defense please complete and submit the [dissertation defense announcement form](#). For details, see Section 8.

**Step 10** **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-semester count as a full semester. For part-time PhD students, four semesters of part-time registration fulfills the residency requirement.

**Step 11** 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 8.

## 7 Checklist for PhD Students with no MS Degree (PhD, BS entry)

**Step 1** If you have a research advisor, he/she will be your academic advisor as well. If you do not yet have a research advisor, you will be advised by Faith Crisley at [f.crisley@neu.edu](mailto:f.crisley@neu.edu) until you have found a research advisor. It is essential that you meet your academic advisor *prior to the registration period for each semester* and review your course selection with him/her.

**Step 2** Plan a program of study for your degree *in consultation with your academic advisor*. Make sure that all prerequisites are taken before the time you plan to register in a course (for course description and pre-requisites see [here](#)).

**Step 3** If you do not already have a research advisor, talk to the ECE faculty about their research interests and find a research advisor whose research matches your interests and background. Your research advisor can be any tenured, tenure-track, affiliated, or adjunct ECE faculty. A list of ECE faculty can be found on the ECE website. After finding a research advisor, complete and submit the research advisor form found [here](#). Your research advisor will serve as your academic advisor. The deadline for finding a research advisor is *one year after your matriculation* at NEU. For details see Section 8.

**Step 4** **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 three concentrations CNWS, CSYS, CVLA (or the legacy CMPE concentration for students entering the program in fall 2015 or before). PhDEE students must complete MSECE requirements in one of the four concentrations CCSP, ELPO, MSMD, POWR.

**Note 3** After completing the requirements for MST or MSC, if interested, you can file a petition to receive an MSECE degree. You need to produce a list of the courses that you want to count towards your MS degree and attach the list to your petition.

**Step 5 Qualifying Exam, Dissertation Proposal Review, Dissertation Defense:** These requirements are similar to those on “Checklist for PhD Students with MS Degree”. Please refer to pages [14-17](#).

For more details on stages and deadlines for PhD students see Section [8](#).

## 8 Stages and Deadlines in the PhD Program

The ECE PhD programs (PhDEE and PhDCE) have certain course and dissertation requirements. The course requirements depend on whether the student matriculates with a BS degree or with an MS degree. These requirements are at least 16 SH of graduate-level courses for those matriculating with MS and 40 or 48 SH for those matriculating with BS; depending on whether they complete an MS thesis or not. The details of the PhD course requirements are given on pages [14-18](#).

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. Finding a research advisor and completing and filing the PhD Research Advisor Form found [here](#)
3. Forming the PhD committee and filing the PhD Committee Form found [here](#)
4. Completing the “Dissertation Proposal Review” stage and filing the Dissertation Proposal Review Form found [here](#)
5. Defending the dissertation and filing it with the GSE

### 8.1 The Qualifying Exam

The ECE qualifying exam is administered one a year during the spring semester in five concentrations of CCSP, CMPE, ELPO, MSMD, and POWR. All full-time PhD students holding an MS degree who matriculate in fall are required to take the qualifying exam the first time it is offered (in the spring of their first year as a PhD student). Students matriculating in fall with a BS degree, all students matriculating in spring, and all part-time students matriculating in fall can choose to take the qualifying exam in their second spring at NU. Part-time students matriculating in spring can take the exam in their third spring semester at NU. Under extenuating circumstances, and with approval of the Graduate Affairs Committee, students can petition to delay their qualifying exam for one year *only once*. This petition should be filed *by January 31 of the year the student is supposed to take the exam*. **Failure to take the qualifying exam on time is considered as failure in the exam.**

PhDCE students take the QE in Computer Engineering; PhDEE students can take the exam in one of the four concentrations of CCSP, EMPO, MSMD, and POWR, depending on their research

focus. Students who fail the QE in their first attempt have one more chance to take the exam and must take it the first time it is administered after their first attempt. The result of the QE can be “pass”, “fail”, or “conditional pass”. If a student passes the QE conditionally, a set of conditions and corresponding deadlines are set to be achieved by him/her to fully pass the QE. Upon full passing of the QE, the status of the student changes from “Predoctoral Student” to “PhD Candidate”. Note that “PhD student” is a general term that is used for both “Predoctoral Students” and “PhD Candidates”. After achieving PhD candidacy, the student must register in “PhD Dissertation” in two consecutive semesters.

To register in the qualifying exam, please download and complete the PhD qualifying exam registration form from [here](#) and follow the instructions.

## **8.2 Finding a Research Advisor**

A student has formally a research advisor when the [PhD Research Advisor Form](#) is completed, signed by the student and the advisor, and filed with the students services coordinator of the ECE department. The research advisor can be any tenured, tenure-track, affiliated, or adjunct ECE faculty. All PhD students must have a research advisor within one calendar year after their matriculation at NU; otherwise, their status changes to MS course-only track. If, after change of status, these students can find a research advisor, their status will be reset to PhD.

After finding a research advisor, please complete and submit the research advisor form found [here](#).

## **8.3 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. After forming this committee the PhD Committee Form is completed, signed by the advisor, the Committee members, and the student, and is filed with the students services coordinator. This form can be found [here](#). The deadline for filing this form is the last day of the spring semester following the spring semester in which the qualifying exam was passed (full, or conditional); however, it is strongly recommended that the students form their PhD committee by the end of the fall semester after passing their qualifying exam. For part-time students this deadline is the last day of the second spring semester after passing the qualifying exam.

The composition of the P.D. committee can change as a result of availability of faculty, change in the direction of research, etc. After each change in the PhD committee, a new [PhD Committee Form](#) should be filed.

## **8.4 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](#). 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 student's PhD committee. This date is after the student has achieved PhD candidacy, has passed the 16 SH course requirements after MS, has taken two semesters of EECE 9990, 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.

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 is filed with the student services coordinator. 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.

## 8.5 Dissertation Defense

Dissertation defense must be scheduled **not sooner than six months after the date of the dissertation proposal review**. The form to announce dissertation defense can be found [here](#).  $\LaTeX$  templates for preparing PhD dissertation can be found [here](#).

The deadlines outlined above are applicable to all students matriculating in fall 2015 and after. The students matriculating before fall 2015 who have already passed the qualifying exam, must file the [PhD Research Advisor Form](#) and the [PhD Committee Form](#) by the last day of spring semester 2016.

## 9 The PhD Annual Review

All PhD students are reviewed annually starting with their second year at the ECE Department. The review process is carried out by the student's "PhD Committee". Before the review process, the student completes a form and submits a one page report of his/her progress during the past year. The committee, based on the recommendation of the advisor, and its own review of the student's progress, evaluates the performance of the student and each committee member gives the student a grade of "excellent", "satisfactory", or "unsatisfactory". The PhD annual review form can be found [here](#). If the committee deems necessary, it can provide more detailed feedback and set goals to be achieved by the student in the next year.

Student who receives two or more unsatisfactory grades will be scheduled to meet with the reviewing committee to receive the necessary feedback. In this meeting goals are set for next year.

Students who receive two or more "unsatisfactory" grades from the committee members in two consecutive years are terminated from the PhD program unless they can find another advisor by the end of the spring semester of the review year.

The deadline for students' reports to their committees is the last day of September and the Committees' reports to the students services administrator are due by the end of October. Students who have not yet formed their PhD committee are reviewed by three-member committees assigned by the GAC.

## 10 Petition and Registration Override Procedures

Please note the following:

1. Petitions/overrides for taking courses must be filed and approved **BEFORE** registration in the course.
2. Filing a petition/override **does not mean that it will be approved**, you need to receive the approval to go ahead.
3. Please file your petitions/overrides well in advance. Processing a petition/override takes at least 5 business days.
4. When submitting your petition/override make sure it is completed and signed by you. If you are a PhD or MST student and have a research advisor the form must be signed by him/her as well. If the signature of the instructor is needed (for override forms), please make sure that you obtain the signature.
5. All petitions/overrides must be submitted with a pdf copy of your current transcripts.
6. The only acceptable format for petitions/overrides and transcripts is PDF. Other formats like JPEG, PNG, etc. are not acceptable.

Here are the steps for filing petitions/overrides:

1. To file a petition:
  - (a) Download the petition form from [here](#).
  - (b) Complete the form, sign it, and get other necessary signatures as described in part 4 above.
  - (c) Save the completed form as a pdf file.
  - (d) Download a copy of your current transcripts and save it as a pdf file.
  - (e) Send **both** pdf files to Faith Crisley at [f.crisley@neu.edu](mailto:f.crisley@neu.edu) in a *single* email. The subject of your email should be "Petition by XXX NUID YYY", where XXX is your complete official name (first and last name as appears on your transcripts) and YYY is your NUID number. Make sure that you send your email from your husky email account.
2. To file a registration override form (these forms are used to register in courses that have restrictions, for example, EECE7674, EECE7400, EECE8986, EECE9986):
  - (a) Download the override form from [here](#).
  - (b) Complete the form and get the necessary signatures as explained in part 4 above.
  - (c) If the form is for pre-requisite waiver, get the signature of the instructor too.
  - (d) Save the completed form as a pdf file.
  - (e) Download a copy of your current transcripts and save it as a pdf file.

- (f) Send both pdf files to Faith Crisley at [f.crisley@neu.edu](mailto:f.crisley@neu.edu) in a single email. The subject of your email should be “registration override Form by XXX NUID YYY”, where XXX is your complete official name (as appears on your transcripts) and YYY is your NUID number. Make sure that you send your email from your husky email account.
3. If you want to register in a CS class, you need to fill in a form at [CCIS course registration form](#). College of Computer and Information Science (CCISS) courses are open only to their own concentrations/degrees during the initial preregistration period.

## 11 Probation Policies and Procedures

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

## 12 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.

Internship is an option for PhD students only to provide them with work experience that is integral to the student’s education, i.e., required for their dissertation research. Internship provides the opportunity to further the students’ training and knowledge in an area central to advancement of their research. It does not refer to an “internship” as used by companies, agencies and other institutions. Examples include students working at a company, government lab or other entity whereby the tasks, data, protocols, etc. will be brought back to NU and used in an integral way in the advisor’s lab and the student’s research. For more information on CPT-internship, see [CPT-Internship](#).

Coop is available to **all** graduate students (MSC, MST, and PhD) and its goal is to provide students with actual work experience in their field of study and need not be research oriented (though it often is).

### 12.1 Eligibility and Requirements

#### Coop:

1. Full time MSC students who
  - (a) Have finished at least two semesters of graduate work at Northeastern
  - (b) Have taken and passed the ENCP 6100 course (Introduction to Cooperative Education)
  - (c) Have a GPA of 3.2 or higher
  - (d) Have a TOEFL score of at least 90
  - (e) Have passed at least 16 SH and at most 24 SH of course work (including any transfer credits).are eligible to apply for coop.
2. Full-time MST students who satisfy conditions (a) through (e), have a research advisor, and their research advisor has approved their participation in coop are eligible to apply for coop.

3. Full-time PhD students who satisfy conditions (a) through (d), have a research advisor, and their research advisor has approved their participation in coop are eligible to apply for coop.
4. During coop the student must be registered in EECE 6964 (Coop Work Experience, 0 SH) to maintain full-time status.

For more information on eligibility for coop, please see this link [coop eligibility](#).

### **Internship:**

1. All PhD students who have a research advisor, have received an internship offer, and their research advisor has clearly approved that the internship is an integral part of their dissertation research, can apply for CPT-internship.
2. During internship the student must be registered in one of the following courses (or course combinations) to maintain full-time status:
  - (a) EECE 9990 (PhD Dissertation, 0 SH)
  - (b) EECE 9996 (PhD Dissertation Continuation, 0 SH)
  - (c) EECE 9986 (PhD Research, 0 SH)
  - (d) EECE 8986 (Master's Research, 0 SH)
  - (e) EECE 7990 (Master's Thesis, 8 SH). This case is very rare.
  - (f) EECE 7990 (Master's Thesis, 4 SH) and EECE 8986 (Master's Research, 0 SH)
  - (g) EECE 7996 (Master's Thesis Continuation, 0 SH)

## **12.2 Duration and Timeline**

The total duration of coop and/or internship cannot exceed twelve months over the length of the entire degree program.

The starting and ending dates of an internship can be at any time during the student's degree program, except during their last semester at Northeastern. A coop work experience, however, must match the Northeastern academic calendar, and as such will be over the summer or during a semester, or a combination thereof.

## **12.3 Applying for Coop and Internship**

### **Applying for Coop:**

1. Graduate students must declare their intention to participate in the co-op process by completing an Application Form (found [here](#)). The Application Form should be completed and submitted electronically to Rachel Walsh ([ra.walsh@neu.edu](mailto:ra.walsh@neu.edu)) early in the semester prior to Co-op .
2. When the student receives an offer of employment for a coop, he/she should meet with their coop faculty coordinator (Rachel Walsh at [ra.walsh@neu.edu](mailto:ra.walsh@neu.edu)) to discuss the opportunity prior to accepting the offer or agreeing to coop dates. If not in NU Careers, an electronic copy of the employer information and position description should be submitted to the coop faculty coordinator. An offer letter should also be submitted. Coop faculty coordinator will place student in NU Careers. For F-1 Visa students, items 3-8 apply.

3. Based on approval by the coop faculty coordinator, OGS Form 150 will be completed.
4. Coop faculty coordinator will check student's I-20 end date. If the I-20 end date allows the coop to be completed prior to the end date, then
  - (a) MS students should submit the completed Form 150 to OGS for CPT Work Authorization.
  - (b) PhD students should submit Form 150 to COE Graduate office (130 SN) for SEVIS contact signature, then to OGS for CPT Work Authorization.
5. If the student needs approval for I-20 Extension of end date, student should submit the following electronically as pdf files to Prof. Masoud Salehi, Chair of the Graduate Affairs Committee ([salehi@ece.neu.edu](mailto:salehi@ece.neu.edu)), for approval of the extension
  - (a) Copy of completed Form 150,
  - (b) Copy of Current Transcript (unofficial transcripts are OK)
  - (c) Completed OGS Form 129 for approval.
6. Upon signature of Form 129, Prof Salehi will forward Form 150 and Form 129 to Matthew Podgurski ([m.podgurski@neu.edu](mailto:m.podgurski@neu.edu)), the student services specialist in the GSE, for approval. When approved, Form 129 will be e-mailed to the student for submittal to OGS.
7. Student should upload the approved Form 129 followed by Form 150 to OGS. The student will be notified when their request for CPT Work Authorization (new I-20) is available for pickup.
8. Coop faculty coordinators should check NU Careers to verify students are authorized by OGS to start work.

**Applying for Internship:** PhD students may complete research internships with the approval of their research advisor and department Chair as well as the graduate school. Details can be found [here](#)

## 13 Policies and Procedures for Course Transfer

Graduate students can transfer a maximum of 9 SH (or equivalent) course work from other institutions. 4 SH of course work is defined as 45 hours of lecture. For credit transfer from other institutions, the following conditions must be satisfied:

1. Student should have a grade at least B (or equivalent) in the course.
2. The course must be passed during the past seven years.
3. The course should not be part of the requirements of a degree received by the student in the past.
4. The course will be reviewed by the Graduate Affairs Committee and should be approved as equivalent to a graduate-level Northeastern course that students can take as part of their degree program.



The process for transfer credit requires filing a petition (see Section 10). The petition should be accompanied by the detailed syllabus of the course (including textbook information) and the equivalent NU 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 *or* be sent in a letter/formal email from the Student Service Coordinator (or equivalent) confirming credits were not used towards a degree in the former institution.

## 14 Policies and Procedures for Requesting Changes 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 in order to make an informed decision. The only request for change in the program that is accepted 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.

1. 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 10. FT PhD students cannot change to PT before having a research advisor. Change from FT to PT for international students is only possible if it complies with the ISSI rules.
2. Change of concentration for MS students (MSC and MST): To apply for change of concentration a minimum cumulative GPA of 3.00 is required. A student has only two chances for change of concentration. Once at the end his/her first semester of study at NU and another time at the end of the second semester at NU. If a student does not apply for change of concentration at these times, or applies but his/her petition is denied he/she will not have another opportunity to apply for change of concentration. To apply for change of concentration you need to file a "Change in Degree Program/Concentration" form, which can be downloaded from [here](#), and email it with your transcripts to Faith Crisley at [f.crisley@neu.edu](mailto:f.crisley@neu.edu). If you are an MST student you also need the agreement of an ECE faculty (tenured/tenure track, affiliated, or adjunct) to be your thesis advisor. To do this, first get a letter or an email from the faculty clearly stating that he/she would be your thesis advisor and email it with your completed "Change in Degree Program/Concentration" form to Faith Crisley. Change of concentration petitions are reviewed by the Graduate Affairs Committee and approved or rejected.
3. Change from MST to MSC: This is done by filing a petition (see Section 10) after finishing at least one semester at NU.
4. Change from MSC to MST: In addition to filing a petition (see Section 10) you need the approval of an ECE faculty (tenured/tenure track, affiliated, or adjunct) to be your thesis advisor. To do this, first get a letter or an email from the faculty clearly stating that he/she would be your thesis advisor and email it with your petition to Faith Crisley at [f.crisley@neu.edu](mailto:f.crisley@neu.edu).
5. Change from PhDEE to PhDCE or from PhDCE to PhDEE: You need to file a "Change in Degree Program/Concentration" form, which can be downloaded from [here](#), and email it with your transcripts to Faith Crisley at [f.crisley@neu.edu](mailto:f.crisley@neu.edu). You also need to complete a new application

in [Apply Yourself](#) by creating a new account and following the instruction on page 2 of the Change of Degree Program Form. Your application fee will be waived; do not send in any payment.

If at the same time you are also changing your research advisor, you 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 International Student and Scholar Institute on campus.

6. Change from PhD to MS: You need to file a "Change in Degree Level" form, which can be downloaded from [here](#), and email it with your transcripts to Faith Crisley at [f.crisley@neu.edu](mailto:f.crisley@neu.edu). You need to get the signature of your research advisor on this form.
7. Change from MS to PhD: You need to file a "Change in Degree Level" form, which can be downloaded from [here](#), and email it with your transcripts to Faith Crisley at [f.crisley@neu.edu](mailto:f.crisley@neu.edu). You also need to complete a new application in [Apply Yourself](#) by creating a new account and following the instruction on page 2 of the Change of Degree Program Form. Your application fee will be waived; do not send in any payment. If an ECE faculty is willing to be your PhD advisor, please ask him/her to write a recommendation letter for you.

*For International Students Only:* An approved change of degree level from an M.S. degree to Ph.D. degree 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 International Student and Scholar Institute on campus.

## 15 Depth and Excluded Courses for ECE Concentrations

### 15.1 Depth Courses for Communication, Control, and Signal Processing (CCSP)

Please see [CCSP Depth Courses](#).

In addition to the courses listed in the link above, the following courses are also depth courses for CCSP students:

EECE 7398 Special Topics: Probabilistic System Modeling and Analysis 4 SH

EECE 7398 Special Topics: Humanoid Robotics 4 SH

EECE 7398 Special Topics: Big Data and Sparsity in Control, Machine Learning and Signal Processing 4 SH

### 15.2 Depth Courses for Computer Engineering (CMPE). This list applies only to students who have entered the program in fall 2015 or before and have not changed concentration.

#### ECE Courses

EECE 5626 Image Processing and Pattern Recognition 4 SH

EECE 5627 Arithmetic and Circuit Design for Inexact Computing 4 SH

EECE 5639 Computer Vision 4 SH

EECE 5640 High Performance Computing 4 SH

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 5698 Special Topics in Software Security 4 SH

EECE 5698 Special Topics: Mobile Robotics 4 SH

EECE 5698 Special Topics: Wireless Sensor Networks 4 SH

EECE 5698 Special Topics: Principles of Assistive Robotics 4 SH

EECE 5698 Special Topics: Robotics Sensing and Navigation 4 SH

EECE 5698 Special Topics: Wireless Sensor Networks 4 SH

EECE 5698 Special Topics: Advanced Network Management 4 SH

EECE 5698 Special Topics: Parallel Processing for Data Analytics 4 SH

EECE 5698 Special Topics: Robotics Sensing and Navigation 4 SH

EECE 7205 Fundamentals of Computer Engineering 4 SH

EECE 7240 Analog Integrated Circuit Designs 4 SH

EECE 7313 Pattern Recognition 4 SH

EECE 7332 Error Correcting Codes 4 SH

EECE 7334 Wireless Communications 4 SH

EECE 7352 Computer Architecture 4 SH

EECE 7353 VLSI Design 4 SH  
EECE 7357 Fault-Tolerant Computers 4 SH  
EECE 7360 Combinatorial Optimization 4 SH  
EECE 7364 Mobile and Wireless Networking 4 SH  
EECE 7368 High Level Design of Hardware Software Systems 4 SH  
EECE 7370 Advanced Computer Vision 4 SH  
EECE 7374 Fundamentals of Computer Networks 4 SH  
EECE 7376 Operating Systems: Interface and Implementation 4 SH  
EECE 7390 Computer Hardware Security 4 SH  
EECE 7393 Analysis and Design of Data Networks 4 SH  
EECE 7394 Network and System Security 4 SH  
EECE 7397 Advanced Machine Learning 4 SH  
EECE 7398 Special Topics: Probabilistic System Modeling and Analysis 4 SH  
EECE 7398 Special Topics: Compilers 4 SH  
EECE 7398 Special Topics: Advanced Computer Architecture 4 SH  
EECE 7398 Special Topics: Advanced Topics in Scalable and Sustainable System Design 4 SH  
EECE 7398 Special Topics: Big Data and Sparsity in Control, Machine Learning and Signal Processing 4 SH  
EECE 7398 Special Topics: Human Centered Computing 4 SH

#### **Mathematics Courses**

MATH 7232 Combinatorial Analysis 4 SH  
MATH 7233 Graph Theory 4 SH

#### **CCIS Courses** (subject to space availability, offering and approval from CCIS)

CS 5100 Foundations of Artificial Intelligence 4 SH  
CS 5200 Database Management Systems 4 SH  
CS 5310 Computer Graphics 4 SH  
CS 5340 Computer-Human Interaction 4 SH  
CS 5400 Principles of Programming Languages 4 SH  
CS 5500 Managing Software Development 4 SH  
CS 5600 Computer Systems 4 SH  
CS 5770 Software Vulnerabilities and Security 4 SH  
CS 6110 Knowledge-based Systems 4 SH  
CS 6200 Information Retrieval 4 SH  
CS 6310 Computational Imaging 4 SH  
CS 6410 Compilers 4 SH  
CS 6510 Advanced Software Development 4 SH  
CS 6520 Methods of Software Development 4 SH

CS 6530 Analysis of Software Artifacts 4 SH  
CS 6540 Foundations of Formal Methods and Software Analysis 4 SH  
CS 6610 Parallel Computing 4 SH  
CS 6740 Network Security 4 SH  
CS 6750 Cryptography and Communication Security 4 SH  
CS 6760 Privacy, Security and Usability 4 SH  
CS 6810 Distributed Algorithms 4 SH  
CS 7800 Advanced Algorithms 4 SH

### **15.3 Depth Courses for Computer Networks and Security (CNWS)**

Please see [CNWS Depth Courses](#).

In addition to the courses listed in the link above, the following courses are also depth courses for CCSP students:

EECE 5698 Special Topics: Advanced Network Management 4 SH

### **15.4 Depth Courses for Computer Systems and Software (CSYS)**

Please see [CSYS Depth Courses](#).

In addition to the courses listed in the link above, the following courses are also depth courses for CCSP students:

EECE 7398 Special Topics: Advanced Topics in Scalable and Sustainable System Design 4 SH

### **15.5 Depth Courses for Computer Vision, Machine Learning, and Algorithms (CVLA)**

Please see [CVLA Depth Courses](#).

In addition to the courses listed in the link above, the following courses are also depth courses for CCSP students:

EECE 5698 Special Topics: Parallel Processing for Data Analytics 4 SH

EECE 5698 Special Topics: Robotics Sensing and Navigation 4 SH

EECE 7398 Special Topics: Big Data and Sparsity in Control, Machine Learning and Signal Processing 4 SH

## 15.6 Depth Courses for Electromagnetics, Plasma, and Optics (ELPO)

Please see [ELPO Depth Courses](#).

In addition to the courses listed in the link above, the following courses are also depth courses for ELPO students:

EECE 5698 Special Topics: Introduction To Multiferroic Materials and Systems 4 SH

EECE 7298 Magnetic Materials Fundamentals and Measurements 4 SH

## 15.7 Depth Courses for Microsystems, Materials, and Devices (MSMD)

Please see [MSMD Depth Courses](#).

In addition to the courses listed in the link above, the following courses are also depth courses for MSMD students:

EECE 5698 Special Topics: Thin Film Technologies 4 SH

EECE 7398 Special Topics: Power Management Integrated Circuits 4 SH

## 15.8 Depth Courses for Power Systems, Power Electronics, and Motion Control (POWR)

Please see [POWR Depth Courses](#).

In addition to the courses listed in the link above, the following courses are also depth courses for POWR students:

EECE 7323 Numerical Optimization Methods 4 SH

EECE 7398 Special Topics: Power Management Integrated Circuits 4 SH

## 15.9 Breadth Course for All Concentrations

The following course can be taken as breadth for all concentration but cannot be taken as depth for any concentration

EECE 7399 Preparing High Stakes Written and Oral Materials 4 SH

## 15.10 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.

The following two classes of course are excluded:

1. All courses offered by the Interdisciplinary Masters Programs, also known as Professional Masters Programs (for instance, Computer Systems Engineering CSYE, Energy Systems ENSY, Engineering Management EMGT, Information Systems INFO, Sustainable Building Systems SBSY, Telecommunications Systems Management TELE, ...) are excluded.

2. The following courses from CCIS are also excluded.

CS 5010 Programming Design Paradigm 4 SH

CS 5320 Digital Image Processing 4 SH

CS 5330 Pattern Recognition and Computer Vision 4 SH

CS 5520 Mobile Application Development 4 SH

CS 5610 Web Development 4 SH

CS 5700 Computer Networks 4 SH

CS 5800 Algorithms 4 SH

CS 6350 Empirical Research Methods 4 SH

CS 6710 Wireless Networks 4 SH

## 16 Grading Guide for Special Graduate Courses

Course #	Course Title	Credits	Grading	Comments
EECE 7400*	Special Problems in EE	1-4 SH	A to C- or F	Can be taken for up to 4 SH in the MSECE and up to 4 SH in the PhD program. Usually taken as 4 SH.
EECE 7674*	Master's Project	4 SH	IP (in progress) if not completed in one semester; otherwise A to C- or F	
EECE 7990	Master's Thesis	4 or 8 SH (usually two semesters, 4 SH in each)	IP before defense, after defense changed to A to C- or F.	8 SH total, can be taken in one or two semesters.
EECE 7996	Master's Thesis Continuation	0 SH	S/U (satisfactory or unsatisfactory)	For students who, after taking 8 SH of EECE 7990, have not yet defended their MS thesis. This course maintains FT** status.
EECE 8986*	(MS) Research	0 SH	S/U	For MSECE project students who, after taking 4 SH of EECE 7674, have not yet finished their project. This course maintains FT** status.
EECE 9986*	(PhD) Research	0 SH	S/U	For PhD students who have not fully passed the qualifying exam but want to do research. Also PhD students who commence the program in summer should register in this course. This course maintains FT** status.
EECE 9990	Dissertation	0 SH	S/U	Taken in two consecutive semesters after fully passing the qualifying exam. This course maintains FT** status.
EECE 9996	Dissertation Continuation	0 SH	S/U	For PhD students that after taking two semesters of EECE 9990 have not yet defended their dissertation. This course maintains FT** status.

See next page for details



Please note the following:

- During internship students must be enrolled in one of the following courses or course combinations:
    1. EECE 9990 (PhD Dissertation, 0 SH, FT\*\* Equivalent)
    2. EECE 9996 (PhD Dissertation Continuation, , 0 SH, FT\*\* Equivalent)
    3. EECE 9986 (PhD Research, 0 SH, FT\*\* Equivalent)
    4. EECE 8986 (Master's Research, 0 SH, FT\*\* Equivalent)
    5. EECE 7990 (Master's Thesis, 4 SH) and EECE 8986 (Master's Research, 0 SH, FT\*\* Equivalent)
    6. EECE 7996 (Master's Thesis Continuation, 0 SH, FT\*\* Equivalent)
  - Students on Coop must be enrolled in EECE 6964 (Coop Work Experience, 0 SH, FT\*\* Equivalent).
  - During the summer terms, registration in these courses is for full summer *not* summer 1 or 2.
  - Continuing PhD students who have passed two semesters of EECE 9990 (PhD Dissertation) 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 of that summer*. If they are graduating in August, they have to register in this course *for the entire summer semester*.
- (\*) You need to file a registration override form for this course. Please see Section 10. *This process needs to be repeated each semester and for all starred courses.*
- (\*\*) Registering in this course is equivalent to registering full-time.

## 17 Useful Links

- General Information Links
  1. [Academic Integrity Policies](#)
  2. [Code of Student Conduct](#)
  3. [COE Coop Eligibility Page](#)
  4. [COE Probation Policies](#)
  5. [Course Descriptions and Prerequisites](#)
  6. [ECE Department website](#)
  7. [ECE Graduate Studies website](#)
  8. [Gordon Leadership Program](#)
  9. [Graduate School of Engineering](#)
  10. [NU 2015-16 Graduate Catalog](#)
  11. [NU Graduate Students Government](#)
  12. [Official University Calendar](#)
  13. [Registrar's Office](#)
  14. [University Health and Counseling Services](#)
  
- Links to Forms
  1. [Announcement form for MS Thesis Defence, PhD Proposal Review, or Dissertation Defense](#)
  2. [Apply Yourself](#)
  3. [Change in Degree Program/Concentration](#)
  4. [Change in Degree Level](#)
  5. [Coop Application Form](#)
  6. [Dissertation Proposal Review Form](#)
  7. [Internship authorization form](#)
  8. [OGS \(previously ISSI\) Forms](#)
  9. [L<sup>A</sup>T<sub>E</sub>X templates for MS thesis and PhD dissertation](#)
  10. [Petition Form](#)
  11. [PhD Annual Review Form](#)
  12. [PhD Committee Form](#)
  13. [PhD Research Advisor Form](#)
  14. [Qualifying Exam Registration Form](#)
  15. [Registration Override Form](#)
  16. [Various ECE Forms](#)
  17. [Various Graduate School of Engineering Forms](#)