

Electrical and Computer Engineering Graduate Program Handbook

5/3/2024

Overview

This ECE Graduate Program Handbook provides information for students, faculty, and staff to supplement our [ECE Graduate Program Policy](#). It includes guidelines and best practices.

ECE Graduate Degree Programs

The ECE Department offers the following in-person graduate programs:

- Graduate Certificates in Electrical and Computer Engineering
- Master of Science in Electrical and Computer Engineering (M.S.E.C.E.)
- Doctor of Philosophy in Electrical and Computer Engineering (Ph.D.)

The program requirements for the M.S.E.C.E. and Ph.D. can be found in the [ECE Graduate Policy](#), while the program requirements for the Graduate Certificates are contained in the [ECE Graduate Certificate Policy](#).

Graduate Program Questions

Questions regarding the Graduate Program should be directed to the [ECE Graduate Coordinator](#) or the [ECE Associate Chair for Graduate Studies](#).

Faculty Advisors and Research Advisors

As described in the [ECE Graduate Program Policy](#), each graduate student will have a faculty advisor. For beginning students, the faculty advisor works with the student in planning his/her program, monitors student progress, and is available to advise and help the student. Once students begin their thesis and/or dissertation research, the faculty advisor becomes their research advisor.

Each student in the thesis M.S. ECE and Ph.D. programs must select, by mutual agreement and shared research interests, a faculty advisor during the first year of study. Students that have not secured a faculty advisor after a year of study will be assigned an advisor by the Graduate Committee. With the approval of the Graduate Committee, a student may select a qualified faculty member that does not have a faculty appointment in ECE, but will also be required to have a co-advisor with a faculty appointment in ECE.

Monitoring Research Progress

For students in programs with a research component (MS with Thesis or Ph.D.), research progress should be continually monitored by the research advisor. Students are expected to make continued research progress. Inadequate progress, or mismatch in the advisor-student

relationship will require changes in the research path. Research advisors should provide and receive feedback from each graduate student advisee. Research progress, expectations, and long term goals should be discussed in a frank manner. The ECE Department strongly encourages advisors to document discussions in writing at least once a year, following the end of the Spring semester. A suggested template is the ECE individualized development plan (IDP). Annual research progress reports including mutual feedback from advisor and advisee are required for all Ph.D students. Students receiving ECE department funding (scholarship or TA) need to submit their annual research progress reports to the Graduate Coordinator by June 1.

Changing Research Advisors

If a student or research advisor wishes to terminate the advisee/advisor relationship, there should be mutual agreement and/or sufficient advance notice.

- If there is *mutual agreement* between the current student and research advisor to change research advisor, the student should complete a Change of Advisor form, which will make the change effective at the time of submission to the [ECE Graduate Coordinator](#).
- If a *student wishes to seek a new research advisor* and the current research advisor is not supportive of a transition, the student should discuss the situation with the Associate Chair for Graduate Studies three months prior to a proposed transition, and prior to securing a new research advisor.
- If a *faculty member seeks to discontinue serving as a research advisor* due to performance, fit to research group, and/or ability to support the research due to issues such as funding support, the research advisor must provide three months advance notice to the student and the Associate Chair for Graduate Studies. The Graduate Committee will provide feedback to the student on a path forward, which may include an interim remedial plan or assistance in identifying a new research advisor. The student may join another research group, switch programs, or leave the program.
- The student and faculty member should both contribute to a smooth transition, maintaining productivity on planned research activities and funded work until the transition. Unless there is agreement between the student, the current research advisor, and the new research advisor, the change of advisor will occur three months after the advisor or the student provides a written notice to the other party.

Following a change in research advisors, both the student and the former research advisor will have access to all products resulting from their joint research. Unless an exception is granted by the Department Chair, if the student wishes to utilize research performed under the supervision of the former advisor in his/her Master's thesis or Doctoral dissertation, the former research advisor will have the option to serve on the thesis or dissertation committee as a co-advisor. The thesis/dissertation committee members will be chosen by mutual agreement between the student, the new research advisor and the former research advisor serving now as co-advisor.

Financial Aid

A number of fellowships, research assistantships, and teaching assistantships are awarded on a competitive basis each year to full-time graduate students in the Department. In addition, the University awards various [competitive fellowships](#) each year to particularly outstanding students. Both entering and continuing graduate students are eligible for financial aid. If awarded financial aid, students entering with a bachelor's degree are typically supported for a maximum of two years for a Master's degree, or a maximum of five years for a Ph.D. degree. Students entering with a Master's degree are typically supported for a maximum of four years for a Ph.D. degree.

Fellowships

Graduate fellowships provide financial support for students to pursue research and studies without directly defined teaching or research responsibilities. There are a variety of internal and external (including NSF, DoD, DoE, and industry) fellowship programs for which students are strongly encouraged to apply. The ECE department offers a limited number of competitive scholarships for first year Ph.D. students. ECE first year department scholarship recipients are fully supported in the first semester, so that they are able to explore different research groups, and should identify a research advisor to begin working with in the second semester. Current MS or undergraduate students who plan to continue for the Ph.D. program are encouraged to apply.

Research Assistantships

Research Assistantships are awarded by individual faculty to students for work on specific research projects. Typically, the work of Research Assistants (RAs) is directly related to their thesis or dissertation, but this is not always the case. The direct responsibilities of RAs have a maximum of 20 hours/week. Typically, Research Assistant contracts cover semester, nine months (academic year, from September to May) or twelve months (September to August) duration. Before contract renewal, a student should discuss with his/her advisor the type of contract to be signed. Before the end of a nine-month contract, the advisor may offer to extend the contract to the summer months, but the student is not obligated to accept the extension. If a contract is not going to be renewed, the advisor should provide a three months notice to the student (unless the non-renewal is a direct result of unexpected grant/contract discontinuation from the sponsor).

Teaching Assistantships

Teaching Assistants (TAs) perform teaching or instructional support for courses for up to 20 hours/week. Activities of TAs may include course preparation, teaching discussion or laboratory sections, and holding office hours. Students may apply for TA positions twice a year following solicitation for TA applicants from the Graduate Coordinator for the Fall or Spring semester. The Graduate Committee will review TA applications and will directly notify selected candidates.

Primary faculty instructors of ECE courses will submit an evaluation form for each TA to the Graduate Coordinator within a month following the end of the semester. TA evaluations will be taken into consideration when making future TA assignments.

PhD Qualifying Exam

Admission to Candidacy

To be formally admitted into Ph.D. candidacy, students must successfully complete the Ph.D. Qualifying Examination and have a Research and Study Program approved by the student's research advisor and the ECE Graduate Committee.

GPA requirement to Take the Qualifying Examination

- Candidates who started the Ph.D. in the ECE program without an M.S. degree in ECE and those who completed an M.S. in the Department must have completed at least four Foundation courses with a GPA of at least 3.50. If more than four Foundation courses have been completed, only the four courses with the highest grade will count to compute the GPA. Unless a rare exception is granted by the Graduate Committee, all the courses should be completed in-person.

If the GPA is less than 3.50, and provided that her/his research advisor approves, a candidate may retake Foundation courses, or take additional Foundation courses up to a maximum of six in total, to satisfy the 3.50 GPA requirement prior to the next Qualifying exam offering. Only the four highest grades achieved in all the Foundation courses will count to compute the GPA requirement for the Qualifying Examination.

- Candidates who started the Ph.D. in the ECE program with an M.S. degree in ECE at another institution have the one-time option to satisfy the GPA requirement by completing four ELEG/CPEG graduate courses. Enrollment in these courses must be approved by the Graduate Committee, which could waive at most two courses for students with excellent coursework in their M.S. At least two of the courses must be Foundation courses in the student's area of concentration. In order to take the Qualifying Examination, the GPA for the required courses must be at least 3.50. Unless a rare exception is granted by the Graduate Committee, all the courses should be completed in-person.

If the GPA is less than 3.50, and provided that her/his research advisor approves, a candidate may retake Foundation courses, or take additional Foundation courses up to a maximum of six in total. The next time the Qualifying Examination is offered, the candidate will be required to satisfy the same GPA requirement as candidates who started their Ph.D. in ECE without an M.S. degree in ECE.

Qualifying Examination

The Qualifying Examination will consist of a research report and oral examination. The objective is to assess the research aptitude of a doctoral student in the early stages of the program. The Qualifying Examination will be offered in June and February, must be completed within two years of admission to the Ph.D. program, and can be taken at most twice. It will include:

1. A research report, equivalent to a four-page conference publication. The topic of the research report will be in the area of research of the student and will thus be selected by the advisor and the doctoral student. The report will reflect the research progress of the student. It should provide sufficient background materials to convey the big picture to an examiner outside the immediate area of the student, the expected impact of the research, as well as a summary of the contributions of the student to date, and possible research approaches.
 - a. The report should be an original document produced wholly by the doctoral student and will be run through plagiarism detection software.
 - b. The research report must be submitted to the Chair of the ECE Graduate Committee three weeks prior to the Qualifying Examination, and will be distributed to faculty examiners.
2. Oral examination, consisting of a short oral presentation (up to 20 minutes in duration), followed by a period of discussion, for a total duration of approximately 60 minutes. The oral presentation will be based on the above research report. The discussion period will revolve around foundational aspects of the problem presented and of the corresponding research area; a list of fundamental topics per research area will be established by the faculty examiners and research advisor and provided to the examinee two weeks before the exam. The discussion period will also provide constructive feedback. The oral examination should also assess the student's ability to creatively think about the research problem presented.

Examiners: The ECE Graduate Committee will select three ECE voting faculty members to examine each student. The selection of the committee will be based on the match between the faculty and the student's research topic and Foundation courses. One faculty examiner should be outside of the student's area of expertise. The student should be able to explain acronyms, technical jargon, and assumptions to an educated non-expert. The student's research advisor may also be present as an observer, but is not allowed to vote on the outcome of the qualifying examination. The advisor could stay for the first few minutes of deliberations in order to provide input on the student's research performance and get feedback on areas of improvement. The advisor and student will not be present during the final grade deliberations by the committee.

Passing of the student will be determined by the committee using following rubric:

1. Ability to communicate (research report/presentation)
2. Technical knowledge (research report/presentation)
3. Fundamental knowledge
4. Research aptitude, creativity, productivity and overall performance

For each of the four criteria above, each committee member will grade the student as Pass/Fail taking into account the following factors:

- Grades of the courses selected to fulfill the Qualifying Examination GPA requirement.
- Quality of the written research report.
- Performance of the student in the oral examination.
- Feedback from the research advisor, who will comment on criteria related to the student's overall performance, including work ethics, research aptitude, creativity, productivity. If the

advisor is not present at the time of the exam, this feedback should be provided in writing to the examiners before the date of the qualifying examination.

The majority of the committee will determine whether the student passes or fails each criterion in the rubric. The student must pass in three of the four criteria.

The outcomes of the Qualifying Examination will be (i) outright pass, (ii) first fail, or (iii) second fail. If the student fails for the first time, the faculty examiners will specify the parameters for taking the Qualifying Examination for a second time. There will be no third chance provided for a student to take the Qualifying Examination. The student should pass the exam within the first two years since admission into the program. A student who ultimately fails the Qualifying Examination for a second time is not eligible to continue in the PhD program, but may apply to change her/his matriculation to the M.S. in ECE degree program. In this case, either the thesis or the non-thesis track can be selected.

Research and Study Program

Students must submit a Research and Study Program (RSP) prior to taking the Qualifying Examination. The RSP details: (1) all courses taken by the student, (2) all future courses planned to be taken in fulfillment of the degree requirements, (3) an abstract of the research to be undertaken in fulfillment of the degree requirements, and (4) a list of the individuals that have agreed to serve on the student's dissertation committee.

Foundation Courses

The ECE Department offers two Foundation Courses in each one of the following concentration areas:

Computer Systems

CPEG 621: Compiler Design

CPEG/ELEG 652: Principles of Parallel Computer Architectures

Network Science

CPEG/ELEG 651: Computer Networks II

CPEG 657: Search and Data Mining

Communications Engineering

ELEG 630: Information Theory

ELEG 635: Digital Communication

Signal Processing

ELEG 631: Digital Signal Processing

ELEG 815: Analytics I – Statistical Learning

Nanoelectronics

ELEG 622: Electronic Materials Processing

ELEG 646: Nanoelectronic Device Principles

Electromagnetics & Photonics

ELEG 682: Optics & Photonics

ELEG 648: Advanced Engineering Electromagnetics

Biomedical Engineering

ELEG 671: Mathematical Physiology

ELEG 604: Imaging and Deep Learning

Cybersecurity

CPEG 672 Applied Cryptography

CPEG/ELEG 694 System Hardening and Protection

Integrated Circuit Design

CPEG 624 Analog Integrated Circuit Design

CPEG 660 Introduction to VLSI Systems

Other Policies

The [College of Engineering](#) and [Graduate College](#) provide additional resources regarding academic support, student life, professional development and funding opportunities.