ELECTRICAL AND COMPUTER ENGINEERING, PHD

Banner Code: VS-PHD-ECE

Academic Advising

MSN 1G5
4400 University Drive
Fairfax, VA 22030

Phone: 703-993-1570
Email: ecephd@gmu.edu
Website: ece.gmu.edu/graduate-studies/phd-programs/ece-phd-program

The PhD program in Electrical and Computer Engineering educates students to do original research on ECE topics and to become technical leaders in their fields. It has a strong and growing reputation, as graduates from the department have become professors at other universities and researchers in various industrial and government research centers. Students may choose a research emphasis in areas such as communications, networking, computer engineering, control and robotics, signal processing, micro/nano-electronics, and bioengineering. The ECE PhD program requires coursework, a qualifying exam, a teaching assignment, a dissertation proposal and research competency exam, a research seminar, dissertation research, and a dissertation defense. Mason's general doctoral requirements apply to this program.

Admissions & Policies

Admissions

All general Mason and specific Volgenau School admission requirements apply. Applicants must submit official transcripts, a resume, a goals statement, three letters of recommendation and official GRE General Test results. The GRE requirement is waived for Mason ECE master's graduates with a 3.0 or greater GPA. Applicants whose native language is not English must demonstrate proficiency by taking the TOEFL or IELTS exam. The minimum score required for admission is 575 on the TOEFL paper-based exam, 230 on the TOEFL computer-based exam, 88 on the TOEFL internet-based exam (with a minimum of 20 in each section), or 6.5 on the IELTS exam. Application materials are reviewed by the ECE PhD committee, which makes a recommendation to the ECE department chair.

Policies

Reduction of Credit

Students must complete a minimum of 72 graduate credits, which may be reduced by a maximum of 30 credits from a completed master's degree. Reduction of credit requires the approval of the program director or designee and the dean or designee of the school. They determine whether the credits are eligible for reduction of credit and applicable to the degree program and the number of credits to be reduced.

Program Requirements

The 72 hours of required doctoral-level credits typically consist of 48 credits of regular coursework and 24 credits of dissertation research. More than half of the 72 credits applied to the doctoral degree must be earned at Mason. The degree plan outlined in Degree Requirements is based on a student who receives a full 30 credit reduction. Students who do not receive a full credit reduction should choose additional credits in consultation with their advisor.

Requirements

Degree Requirements

Total credits: 72

Doctoral Coursework

Courses that constitute a student's plan of study will be chosen in consultation with the student's advisor and/or dissertation committee, to include:

Code	Title	Credits
Select 18-30 credits		18-30
Total Credits		18-30

- 3 credits at the 600-level outside the department in a subject considered foundational for the area of emphasis.
  Typical examples are advanced mathematics or statistics courses for those pursuing an emphasis in communications, signal processing or control, physics courses for those desiring an emphasis in micro/nano-electronics, computer science courses for those pursuing the computer engineering emphasis, and biology courses for those pursuing a bioengineering emphasis. Because such courses are usually not taken for master's degrees, this requirement can rarely be satisfied with a course taken previously.
- 6 credits within the department but outside the area of emphasis.
  This requirement may be satisfied with courses taken during previous studies, subject to approval.
- A maximum of 6 credits may be at the 500-level[1]
- A maximum of 6 credits of individualized reading courses at any level.
  Note that ECE 798 Research Project is primarily a master's level course and is not intended to be part of the PhD coursework.

[1]   For courses taken elsewhere, the equivalent levels are to be determined by the PhD advisor, subject to approval by the ECE Department chair.

Qualifying Exams

The ECE PhD Qualifying Exam tests students' knowledge of fundamental concepts and assesses their basic research skills. The exam consists of two parts: an in-class written technical qualifying exam and a research qualifying exam (RQE).

Technical Qualifying Exam

The Technical Qualifying Exam (TQE) that tests knowledge of fundamental concepts in a particular technical area. Students select one of four areas for their TQE:

1. Control Theory
2. Digital Design and Computer Organization
3. Electronics and Circuits
4. Signals and Systems

The TQE is offered once a year in January before the start of the Spring semester. Students entering the program with a BS or an MS are required

to take the TQE the first time it is offered after they have entered the program. A student who fails the exam will have a second and final chance to pass the exam in the following year. A student who obtains a marginal passing grade in the first attempt of the TQE will be required to take an oral exam in the same area within the subsequent four weeks.   The oral exam will be administered by two ECE faculty members. A student who passes the oral exam will satisfy the TQE requirement. A student who demonstrates marginal performance in the oral exam will be required to take the written exam for the second and final time when it is offered in the following year. A student who fails the oral exam will be dismissed from the program. A student who fails the written TQE twice will be dismissed from the program.

Outstanding students may be exempt from the TQE if they obtain at least an A in two designated courses taken within the twelve months proceeding the first attempt at the TQE, or within the twelve months after the student has failed the TQE in the first attempt. The designated courses are as follows: Area A - ECE 521 Linear Systems and Control and ECE 528 Introduction to Random Processes in Electrical and Computer Engineering; Area B - ECE 545 Digital System Design with VHDL or ECE 590 Selected Topics in Engineering and ECE 511 Computer Architecture; Area C - Any two of ECE 584 Semiconductor Device Fundamentals, ECE 586 Digital Integrated Circuits, ECE 587 Design of Analog Integrated Circuits or ECE 684 MOS Device Electronics; Area D - ECE 521 Linear Systems and Control or ECE 535 Digital Signal Processing and ECE 528 Introduction to Random Processes in Electrical and Computer Engineering.

Research Qualifying Exam

The purpose of the Research Qualifying Exam (RQE) is to assess whether students can define a research problem, critically review the literature related to the problem, apply appropriate research methods to study the problem, and interpret and communicate their results. The RQE requires students to complete a short research project and to document their results in a written report and an oral presentation. The RQE topic is defined by a faculty advisor in consultation with the student. A committee of three faculty members (the advisor plus two additional members) evaluates the written report and the oral presentation. During the presentation the student is expected to answer questions about their project and about fundamental concepts related to the research.

Students who enter the program with an MS degree are encouraged to start working on their RQE as soon as they enter the PhD program and no later than the start of their second semester in the program regardless of their performance on the TQE.   These students are required to present their paper in the RQE exam no later than the end of their second semester in the program. Students who enter the program with a BS degree are required to take the exam prior to completing 30 credits in the program regardless of their performance on the TQE.

Evaluation

The written research paper and the presentation will be evaluated using the following four criteria. Students must receive at least a "competent" raking (three on a scale of one to five) on each of the following four evaluation criteria to pass the RQE:

- Ability to articulate the research problem and its significance.
- Ability to critically review the literature.
- Understanding of research methods.
- Ability to communicate and interpret research results.

After a student has passed the TQE and has taken the RQE, the ECE PhD Committee reviews the exam results, the student's transcript, and a letter of recommendation from the student's advisor. Based on this information, the PhD Committee determines whether the student is qualified for the PhD program. A qualified student will proceed to choose a thesis advisor.

Dissertation Research

A maximum of 24 credits of ECE 998 Doctoral Dissertation Proposal and ECE 999 Doctoral Dissertation may be applied to the degree. Students who choose to take fewer than 24 credits of ECE 998 Doctoral Dissertation Proposal and ECE 999 Doctoral Dissertation may earn the remaining credits from approved course work. Students cannot enroll in ECE 999 Doctoral Dissertation before they have advanced to candidacy. Students advanced to candidacy after the add period for a given semester must wait until the following semester to register for ECE 999 Doctoral Dissertation. Students cannot advance to candidacy and defend their dissertation during the same semester. Once enrolled in ECE 999 Doctoral Dissertation, students must maintain continuous registration in ECE 999 Doctoral Dissertation each semester until graduation, excluding summers. Students who defend in the summer must be registered for at least 1 credit of ECE 999 Doctoral Dissertation during that summer term.

Code	Title	Credits
Select 12-24 credits from the following:		12-24
ECE 998	Doctoral Dissertation Proposal (minimum 9 credits required)	
ECE 999	Doctoral Dissertation (minimum 3 credits required)	
Total Credits		12-24

Advisor, Dissertation Director, and Dissertation Committee

The process of finding a dissertation topic and dissertation director is governed by the university's policies, as described in the Requirements for Doctoral Degrees in the Academic Policies section of the catalog. Upon admission to the program, each student is assigned an ECE faculty member as an academic advisor. After the student passes the qualifying exam, the student proposes and the ECE department chair appoints a dissertation director who must be a Mason graduate faculty member with a full-time appointment. The dissertation director becomes the student's academic advisor. Normally, the dissertation director is a member of ECE department; however, a member of another department may be appointed if warranted by the dissertation research topic. A dissertation committee should be formed within a year after the student has passed the qualifying exam. The dissertation committee consists of the dissertation director who acts as chair plus three or four additional members. All dissertation committees must include at least three members of the Mason graduate faculty, at least two of whom must be from the ECE Department. At least one member of the dissertation committee must be from outside the discipline of electrical and computer engineering. The outside member may be faculty from another Mason department or, if justified by the research topic, a qualified scientist or engineer from outside the university. All committee members must have a doctoral level degree. The dissertation committee must be approved by the ECE department chair. The dissertation director, as academic advisor, and the ECE Department chair must approve all decisions concerning a student's course requirements and dissertation.

Dissertation Proposal, Research Competency Exam, Advancement to Candidacy

The student prepares a written dissertation proposal outlining the proposed research and submits it to the dissertation committee for approval. After completing coursework requirements and preparing a proposal, the student takes a research competency exam to demonstrate their preparation for dissertation research. The exam consists of a presentation of the dissertation proposal followed by an oral exam. The exam is administered by the student's dissertation committee. The purpose of the oral exam is to verify that the student is familiar with the relevant material related to their research. The student is advanced to candidacy when he or she passes the oral exam and the dissertation committee approves the proposal.

Dissertation Research and Defense

Students conduct dissertation research under the guidance of their dissertation director, with regular consultation with other members of the dissertation committee. During this period, students must present their research results at least once in the form of a department seminar. The dissertation must represent an achievement in research, must be a significant contribution to its field, and should be deemed publishable in refereed journals or at highly selective conferences. On completion of the dissertation the student may be asked, at the discretion of the dissertation committee, to present a predefense in the presence of the committee members. The dissertation committee and the department chair approve the student's application for a public defense of the doctoral dissertation. A copy of the dissertation must be placed in the University Libraries four weeks prior to the public defense. After a successful public defense and completion of the final form of the dissertation, the dissertation committee recommends the candidate for the degree of doctor of philosophy.

Teaching Requirement

To acquire teaching experience, each PhD student is required to participate in the department's teaching activity. The requirement is typically satisfied by working as a recitation instructor for one semester, presenting several lectures within a course, or performing other teaching work approved by the department.