ELECTRICAL AND COMPUTER ENGINEERING, PHD

Banner Code: VS-PHD-ECE

Academic Advising

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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:

Select 18-30 credits

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

- 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: a written technical qualifying exam and a research qualifying exam requiring a written report and a presentation.

Technical Qualifying Exam

The Technical Qualifying Exam (TQE) is an in-class written exam that tests knowledge of fundamental concepts in a particular technical area. Students select one of three topics for their TQE:

1. Topic 1: Signals and Systems
2. Topic 2: Digital Design and Computer Organization
3. Topic 3: Circuits, Electronics, and Devices

Students must take the Technical Qualifying Exam within the first year after they have entered the program. The TQE is typically offered in late August, prior to the start of the fall semester. Students who enter the PhD
program in the spring semester may request to take the TQE in January; such a request must be filed by the end of the spring semester.

**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 must take the RQE prior to completing 12 credits in the PhD program. Students who enter the program with a BS degree must take the exam prior to completing 30 credits in the program.

**Evaluation**
After a student has taken both the TQE and 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. If the student does not qualify on their first try, they may repeat one or both of the exams in the following year. The TQE and RQE may be repeated once. A student who fails to qualify on their second try is removed from the program.

**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 coursework. Students cannot enroll in ECE 999 Doctoral Dissertation before they have advanced to candidacy. Students advance 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.

Select 12-24 credits from the following: 12-24

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<thead>
<tr>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>ECE 998</td>
<td>Doctoral Dissertation Proposal (minimum 9 credits required)</td>
</tr>
<tr>
<td>ECE 999</td>
<td>Doctoral Dissertation (minimum 3 credits required)</td>
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</tbody>
</table>

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 pre-defense 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 formal 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.