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PHD DEGREE REQUIREMENTS

DUKE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

The Department of Electrical and Computer Engineering (ECE) offers the degrees of MS, Meng, and PhD in Electrical and Computer Engineering. To obtain these degrees, a student must satisfy certain requirements, some of which are established by the Graduate School and some by the Department of ECE. Please consult the Duke Graduate School Bulletin for the Graduate School requirements. Within ECE, graduate students are typically associated with a curricular group at the start of their studies. In all cases, students must declare their major curricular group and faculty advisor by the end of their first year of studies. The ECE curricular groups are: Computer Engineering; Engineering Physics; Microelectronics, Photonics, and Nanotechnology; Signal and Information Processing.

REQUIREMENTS FOR THE PHD DEGREE

The formal requirements for the PhD are as follows: (1) payment of six semesters of full-time tuition (or five if credit for a previous graduate degree has been approved), (2) major and related courses as determined by the degree program, (3) the fulfillment of foreign language(s) requirements in certain departments, (4) required training in the Responsible Conduct of Research and any English language proficiency courses into which the student has placed, (5) a dissertation advisor and supervisory committee for the student's program of study, (6) residence of at least one year, (7) passing the preliminary examination, (8) completing the dissertation, (9) passing the final examination, and (10) final dissertation submission to ProQuest and DukeSpace for eventual public access.

In ECE, a minimum of 10 graduate courses beyond the Bachelor's degree are required, distributed as follows:

- Six graduate-level courses in ECE (500-level or higher)
- Two approved graduate-level technical electives (500-level or higher, technical in nature, and chosen to provide a coherent program of study)
- Two approved electives (chosen to provide a coherent program of study)

Students may elect to pursue the MS degree while enrolled in the Ph.D. program by fulfilling the requirements of an MS degree during their doctoral studies. (See "Requirements for the MS Degree").

Students entering the PhD program with a Master's degree from another institution must complete a minimum of 5 graduate courses at Duke beyond the Master's as follows:

- Three graduate-level courses in ECE (500-level or higher)
- One approved graduate-level technical elective (500-level or higher, technical in nature, and chosen to provide a coherent program of study)
- One approved elective (chosen to provide a coherent program of study)

Students who have completed a Master's degree at Duke may include any applicable coursework that was taken for that degree on their Program of Study for the PhD program (with advisor approval).

Important Coursework Notes:

- Courses must be worth 3 (or more) graduate semester hours
- Courses must be graded (Credit/No Credit or audited courses may not count toward the program of study)
- ECE 899 Independent Study can be used to satisfy only the Approved Elective requirement
- Undergraduate Courses (numbered 499 or lower) require DGS and Graduate School permission for enrollment and may have special restrictions
- Overall program of study must indicate adequate breadth, including some courses distinctly outside student's main curricular area
- Student must maintain a 3.0 GPA in order to remain in good standing and to graduate

Selection of all courses, particularly in the student's major area, is tailored to the student's background via consultation with his/her advisor and one additional faculty member. Accordingly, depending on the student's preparation and field of research, courses beyond the minimum may be deemed necessary by the advisor.

Newly admitted students entering the PhD program without an undergraduate EE/ECE background (whether or not they already have a master's degree), in consultation with their initial advisor, will propose a first year curriculum that allocates up to two courses, possibly at the undergraduate level, to fill in the ECE background they may be lacking. Note that undergraduate courses (numbered 499 or lower) require DGS and Graduate School permission for enrollment and may have special restrictions, to be indicated at the time of approval.

The final program of study should be chosen to provide a breadth of ECE content knowledge and a coherent program of study and requires approval by the student, the advisor, one additional faculty member, and the Director of Graduate Studies through the submission of a Program of Study form.

Examinations and Other Requirements:

Successful completion of a PhD requires passing the Qualifying Examination, the Preliminary Examination, and the Final Examination, as described below.

1. PhD Qualifying Examination (QE):

The QE consists of two portions: a written report and an oral presentation with Q&A. Each portion will be evaluated separately. Passing the qualifying exam requires a pass on both portions and any failed sections must be retaken the following semester. No more than two attempts are allowed for each portion of the exam.

The purpose of the exam is to assess the student's potential to succeed in the PhD program by having them demonstrate the following:

- Reading and deeply understanding three selected papers in the field
- Understanding the strengths and shortcomings of the three papers
- Understanding why the particular problem space defined by the three papers is important
- Generating sound research ideas based on the strengths and shortcomings of the three papers
- Writing and presenting information supporting the points above

Ideally, the qualifying exam should be taken by the end of the second semester of the first year. However, if necessary, the qualifying exam may be taken during the summer following the first year.

The QE committee will consist of three ECE faculty members generally in the student's area of research. The majority of faculty on the committee should be primary faculty members in the ECE Department. The faculty advisor may not serve on the committee.

The exam consists of two parts, a written report and an oral presentation. First, the student works with their advisor to choose a topic, three key papers from their research field,[1] and an appropriate committee. Once these details are determined, approval is obtained by the student submitting a "QE Plan" form to the ECE Graduate Office. While the advisor and student choose the papers to be analyzed, the papers must be unanimously approved by the committee. The committee has one week to approve the papers, or it is assumed that they are approved.

[1] Note: Excessive repetition of papers in a group is not allowed and the ECE Graduate Office will maintain a database of papers used. Of the three papers submitted for approval, no more than one may have been used in a qualifying exam affiliated with that research group in the previous three years.

A written report (10 pages hard maximum, including references) is generated by the student, which consists of a review of the three papers in the problem space plus a brief synopsis of suggested future research/directions/projects based on what they learned. Note, the suggested future work does not have to be related to the student's research; rather, it should be based on information learned from the three papers. The formatting of the report should be consistent with that acceptable for professional submission (single-column, minimum of 11-point font and 1" margins). In addition to the three papers being reviewed, a few additional references may be cited as needed, but this is not required.

Upon approval of the QE plan, the oral exam may be scheduled (if it was not already scheduled prior to the QE Plan form submission) and cannot be taken sooner than thirty days after approval was received. Once a date is determined, the student must inform the ECE Graduate Office of their scheduled exam date and time. The written report must be provided to the committee two weeks prior to the oral exam date, during which time they will score/evaluate the report. At the oral exam, the student will give an ~ 30 minute presentation (30 slides maximum) about the material in their report, followed by an ~ 30 minute Q&A. If desired by the student, the oral exam (presentation + Q&A) can be video recorded[2] and made available for review by the student and their advisor.

Each portion of the exam (written and oral) is scored as +1 satisfactory, 0 marginal, or -1 unsatisfactory by each committee member. There should be no corroboration among the committee members on either the written or oral scoring of the exam (e.g., student should not be asked to leave the room for a committee discussion); rather, each committee member scores the exam independently and submits that score to the graduate office. The sum of committee members' scores must be positive (i.e., > 0) in order for the student to pass. Each portion (written and oral) is scored, summed, and passed/failed independently.

Score:	Implies:
1	The student has successfully shown readiness for the PhD by demonstrating all elements of the qualifying exam assessment criteria.
0	The student has met some of the criteria for success, but requires improvement in some areas and has failed the exam.
-1	The student has not met the requirements indicating readiness for the PhD.

Committee members must submit their score for the written report to the ECE Graduate Office prior to the oral presentation (an email will be sent to the committee members to solicit submission of these scores). Committee members must submit their score for the oral portion of the exam to the ECE Graduate Office within 24 hours of the presentation (an email link for score submission will be sent to committee members on the morning of the exam). The sum of the committee members scores for each part of the exam are sent to the student and faculty advisor within three business days after the exam. When applicable, the video recording of the oral presentation and Q&A is also made available. The advisor can submit a written petition to the DGS requesting reconsideration of the exam outcome within two weeks of the exam date. Students who do not pass one or both portions of the exam are encouraged to discuss the result with their advisor and/or the DGS. If the student fails either portion, the student may re-take the exam once during the semester following the exam.

2. Additional Requirements:

In addition to successful completion of the QE, students must have a willing advisor to supervise their research in order to continue in the program. In the event of satisfactory academic performance but difficulty in finding a willing advisor, the DGS will help place students who have completed the qualifying process.

[2] This must be requested at the time of QE Plan submission.

Students must demonstrate breadth of general knowledge in ECE through coursework as outlined in the degree requirements. Prior to the Qualifying Exam, the PhD coursework must be chosen and the PhD Program of Study must be approved by the advisor, one additional faculty member whose essential review purpose is to verify breadth of coursework, and the DGS. These courses need not be completed prior to the Qualifying Exam, but should be completed prior to the Preliminary Exam. Note that in order to be certified as making satisfactory progress towards their degree, the Graduate School requires that students must maintain at least a 3.0 (B) cumulative grade point average.

TEACHING ASSISTANTSHIP REQUIREMENT

All PhD students must complete two semesters of a Teaching Assistantship (TA) prior to graduation. It is expected that the student will complete this requirement some time during their third through eighth semester. Teaching Assistantships will be assigned by the DGS based on the background and interests of the student and the current department needs. Teaching Assistantships are expected to require 10 hours per week on average and may involve such activities as organizing and leading discussion sections, grading homework and quizzes, assisting in the development of course materials, supervising laboratory sessions and so forth. Training for engineering TAs is available online and offered in a course one a year.

3. Preliminary Exam:

The preliminary examination is normally scheduled after a student has completed most of their course work, but prior to the main research of the dissertation, and must be completed by the end of academic year three. If it is determined that a student, with justifiable academic or personal reasons, will not complete the exam by the end of year three, a Preliminary Exam extension request must be made directly to and approved by the Graduate School prior to the year three deadline in order to ensure that the student remains in good academic standing. Typically, preliminary exam extensions are granted for no more than one term. The preliminary exam should be scheduled with the ECE Graduate Office at least two weeks prior to the exam date using the Exam Details Form.

The committee that administers this exam is nominated by the student's advisor via the Graduate School's official Committee Approval Form (submitted to the ECE Graduate Office by the student), and must be approved by the Director of Graduate Studies and the Dean of the Graduate School at least one month before the exam takes place. The committee must consist of at least five members (including the student's advisor, who normally serves as committee chair), at least three of whom must be ECE graduate faculty members. In addition, the Graduate School requires that at least one member of the committee be from outside the students' curricular area.

The examination consists of (1) a written dissertation research proposal and 2) an oral presentation and defense of this proposal.

The written dissertation research proposal should consist of a 10-page (maximum) report plus appendices providing additional supporting information. The report, which must be submitted to the committee at least two weeks prior to the exam date, should begin with a one-page executive summary, which answers the following questions and is written at a level that can be understood by an engineering/science student, i.e. using minimal jargon. *Note: these questions are modifications of the Heilmeier questions.*

- What are you trying to do?
- What is known about this topic today, or how is it done today? What are the limits of current practice/understanding?
- What is new in your approach, or what open question are you trying to answer? Why do you think it will be successful?
- Who cares? If you are successful, what difference will it make?
- What are the risks and corresponding plans to mitigate them?
- What are key steps in your effort and when do you anticipate reaching each? How will you judge success?

The remaining pages in the preliminary examination report should expound upon the answers to these questions and should include a concise description of research progress to date. This section should be written at a level to be understood by experts in the field, i.e. the preliminary examination committee.

The document must also contain an anticipated timeline for completion of all PhD degree requirements.

Supporting Information may be included in appendices, which should be organized based upon content. Examples of supporting information include: 1) more detailed information supporting the research plan and approach, 2) papers/presentations, 3) information on collaborations, 4) information on related research in the student's group, 5) relevant mathematical derivations or code.

The presentation should reflect the contents of the report. The typical presentation should be approximately 45 minutes, with extra time allotted for questions posed by the committee throughout and after the presentation.

In order to successfully complete the preliminary exam, at least four of the five committee members including the chair must vote in favor of a pass.

4. Final Exam:

The final examination is normally administered by the same committee as the preliminary exam; if a change is made to the committee, it must be approved by the ECE DGS and the Dean of the Graduate School via the Graduate School's official Committee Approval Form. Successful defense of the dissertation requires at least four affirmative votes, including the affirmative vote of the dissertation advisor. A negative vote by the dissertation advisor means that the student fails.

The student must follow the Graduate School's guidelines for submitting the dissertation and scheduling the examination, including uploading the dissertation at least two weeks prior to the defense.

Note: Details concerning important dates and deadlines, filing of intention to graduate, committee approval, and additional details may be found in the Graduate Bulletin.