

# PHD DEGREE REQUIREMENTS

## DUKE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

The Department of Electrical and Computer Engineering (ECE) offers the degrees of MS and PhD in Electrical and Computer Engineering. To obtain these degrees, a student must satisfy a certain number of requirements, some of which are established by the Graduate School and some by the Department of ECE. Please consult the Duke Graduate School Bulletin (or <http://gradschool.duke.edu/academics/academic-policies-and-forms/phd-degree-requirements>) 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 Graduate School requirements for the Ph.D. degree are as follows: (1) payment of 6 semesters of full-time tuition (or five if credit for previous graduate work has been approved), (2) specified coursework, (3) training in the Responsible Conduct of Research, (4) a supervisory committee for the student's program of study, (5) continuous registration (excluding summer terms), (6) preliminary examination, (7) dissertation, and (8) a final examination.

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

- Six (6) ECE graduate-level\* courses that reflect breadth of study in ECE (ECE 899 courses may not be used as part of this requirement)
- Two (2) approved graduate-level\* technical electives
- Two (2) courses in approved electives†

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 (3) ECE graduate-level\* courses that reflect breadth of study in ECE (ECE 899 courses may not be used as part of this requirement).
- One (1) approved graduate-level\* technical elective
- Five (1) courses in approved electives†

\* Graduate-level courses are numbered 500 and above.

† No more than two 300-level or 400-level undergraduate courses and/or ECE 899 Independent Study courses may be used to satisfy degree requirements. No courses numbered below 300 may be used to satisfy degree requirements. All courses must be graded and worth at least 3 graduate semester hours or equivalent.

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.

The final program of study should be chosen to provide a breadth of ECE content knowledge and a coherent program of study and is subject to approval by the student, the advisor, one additional faculty member, and the Director of Graduate Studies.

Newly admitted students entering the PhD program without an undergraduate EE/ECE background (whether or not they already have an MS 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. This first year curriculum will be reviewed, modified if necessary, and approved by the DGS before the first day of classes. Note that this requirement does not change the student's total number of units required to graduate.

#### 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:

The PhD Qualifying Examination consists of completion of a first-year research project with a written report and oral presentation. The project is intended to demonstrate the student's ability to assemble and analyze the relevant literature for a given research problem and to make preliminary steps towards his/her own contribution.

Selection of an appropriate first-year research topic should be made with the approval of the student's advisor. The project may be started at any time after matriculation. Completion of the project must be accompanied by a written report of approximately 20 pages in length, roughly half of which reviews the relevant field literature (with appropriate references) and half of which describes the student's own progress to date. Both the report and the oral presentation are expected to be predominantly the student's own work (without extensive editing assistance, for example), although students are encouraged to practice their presentation before a technical audience of their peers. The written project report must be completed and submitted to the examination committee at least fourteen (14) calendar days prior to the date of the oral examination. The oral examination will normally be held before the 14<sup>th</sup> month from matriculation, and a request should be made to the DGS if an extension is desired.

The examination committee will consist of four ECE faculty members, including the student's advisor. The three other members of the exam committee will be nominated by the student and approved by the student's advisor and the Director of Graduate Studies. All committee members must be on the faculty of the Graduate School. Normally, two faculty members will be from the student's curricular group and one will be from a different curricular group. For the purposes of these assignments, either a faculty member's primary or secondary group affiliation will apply. The exam details should be submitted to the DGS for approval via the Qualifying Exam Form at least 4 weeks prior to the exam date.

The oral exam will consist of a 30 minute presentation by the student of his/her research project followed by up to 30 minutes of questions about the work, its context, and relevant literature. In addition, as part of the oral exam, the committee will also question the student to assess general preparation to undertake work in the chosen sub-discipline for a minimum of 30 minutes. The examiners will be mindful of graduate courses already taken, research directions pursued to date, and any specific tentative plans the student may have for future

research. The entire oral exam will be limited to 90 minutes. The intent is to assess the student's preparation and potential for graduate level research work in his/her chosen field.

The possible outcomes of the first year exam are "Pass" – the student is qualified to begin work towards the preliminary exam; "Partial Pass"– the student is qualified to begin work towards a preliminary exam but additional coursework or actions are required; and "Fail." A "Pass" or "Partial Pass" outcome requires at least three affirmative votes. Any student failing the qualifying exam on the initial attempt will have one additional attempt by the end of the semester immediately following. Failure of the exam on the second attempt will disqualify the student from further doctoral studies in the Duke ECE program.

## 2. Additional Requirements:

In addition to successful completion of the qualifying process and examination, 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.

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 must 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 his/her 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 his/her course work, but prior to the main research of the dissertation, and must be completed by the end of academic year 3. The examination consists of (1) a written dissertation research proposal, presentation, and defense and (2) an oral examination of fundamentals in the major field and related work. The length of the examination is at least 90 minutes but no more than 2 hours. The committee that administers this exam is nominated by the student's advisor and is 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. 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 formally approved by the ECE DGS and the Dean of the Graduate School. 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.

Note: Details concerning important dates and deadlines, filing of intention to graduate, committee approval, and additional details may be found in the [Graduate Bulletin](#) or at <http://gradschool.duke.edu/academics>.