

The University of Iowa

Department of Electrical and Computer Engineering GRADUATE MANUAL

The primary emphasis of graduate education in Electrical and Computer Engineering is to allow the student to master a particular area of interest and acquire maturity in the general area of electrical and computer engineering. To aid in planning the student's course of study, certain broad outlines are presented here. In addition to the requirements stated in the University Graduate Manual, the student must satisfy all applicable items given in this manual.

MS Degree

Two options are available, a thesis option and a non-thesis option. The requirements which must be satisfied are:

MS without Thesis

1. At least 30 semester hours of graduate approved credit^{^^} in a coherent program approved by the Graduate Committee. This program must include at least 18 semester hours from the approved list of ECE graduate courses.** A total of not more than three semester hours of independent study credit (ECE:5998) may be included in the required 30 semester hours total. All graduate students must take the 1 s.h. Engineering Ethics ENGR:7270 course.
2. At the time of graduation, the cumulative grade point average for all graduate courses counting toward the degree must be 3.00 or higher.

MS Non-Thesis Advisor

The Director of Graduate Studies is advisor to all students selecting the non-thesis option.

MS with Thesis

1. At least 30 semester hours of graduate-approved credit^{^^} in a coherent program acceptable to the advisor and approved by the Graduate Committee. This program must include at least 12 semester hours from the approved list of ECE graduate courses.** A total of not more than eight semester hours of the required 30 semester hours may be earned in ECE:5999 MS Thesis Research or other independent studies (ECE:5998). At least six semester credit hours must be earned in ECE:5999 MS Research. All graduate students must take the 1 s.h. Engineering Ethics ENGR:7270 course.
2. Successful completion of a final examination conducted by a committee of at least three faculty members, of which the advisor is chair. One part of the final examination must consist of an oral defense of the thesis. A comprehensive examination of the student's program is also recommended.
3. At the time of graduation, the cumulative grade point average for all graduate courses counting toward the degree must be 3.00 or higher.

MS Thesis Advisor

For students electing the thesis option, the advisor, or at least one of the co-advisors, must be a member of the Electrical and Computer Engineering faculty.

MS Thesis Committee

The ECE department follows Graduate College guidelines for MS thesis committee composition. Committee composition specifics are outlined here:

<https://grad.uiowa.edu/academics/manual/academic-program/section-x- masters-degrees>

PhD Degree

The program of study for the Ph.D. degree in Electrical and Computer Engineering requires successful completion of minimum course requirements, admission to Ph.D. candidacy, a comprehensive examination, an original research contribution, and defense of a written dissertation.

1. At least 72 semester hours of graduate approved credit^{^^} in a coherent program acceptable to the advisor and approved by the Graduate Committee. At least 45 semester hours must be earned in formal courses (not thesis or other independent study) including 30 semester hours from the approved list of ECE graduate courses.** The program must also include a minimum of 18 s.h. of PhD research (ECE:7999). All graduate students must take the 1 s.h. Engineering Ethics ENGR:7270 course.
2. Admission to Ph.D. candidacy. The Electrical and Computer Engineering (ECE) faculty collectively determines whether a student is admitted to Ph.D. candidacy. Admission is based on the following criteria:
 - a. Research competence – The faculty evaluates the candidate's ability to create, defend, and communicate new knowledge through a department-administered, research-oriented Qualifying Exam and input from the student's Ph.D. adviser.
 - b. Scholastic competence – The faculty reviews the candidate's undergraduate and graduate academic record.
 - c. English proficiency – Students must meet all English proficiency requirements set by the University of Iowa before being admitted to the ECE Ph.D. program.
3. More details are provided on the candidacy process can be found below.
4. Successful completion of the Ph.D. Comprehensive Examination.
5. The PhD Comprehensive Examination will consist of *two* parts: a written research proposal, and an oral examination. *The written research proposal must include a thorough literature survey that provides the motivation and background for the proposal.*
6. The Comprehensive Examination may not be taken before passing the PhD Qualifying Examination. It must be completed no later than three calendar years after passing the Qualifying Examination. Failure to meet this deadline will require retaking of the Qualifying Examination. The Qualifying Examination and the Comprehensive Examination may not be taken in the same semester.
7. Successful completion of a final oral defense of the thesis. At least six months must elapse between the completion of the Comprehensive Examination and the final thesis defense.
8. At the time of graduation, the cumulative grade point averages for all graduate courses and the graduate courses counting toward the degree must be 3.25 or higher.

PhD Thesis Committee

Committees must consist of no fewer than five members, of which four must be tenure-track faculty. At least two faculty members must be from the major department. One member of the committee must be a member of the Graduate Faculty who does not hold a primary appointment in the major department.

ECE PhD Candidacy Process

The process of qualifying for candidacy in the PhD program in Electrical and Computer Engineering consists of three parts: 1) research competence, 2) scholastic competence, and 3) English competence.

1) Research Competence: PhD Qualifying Examination

- a. The focus of the Qualifying Examination is the presentation and discussion of a single, coherent topic based on one published paper.
- b. The Qualifying Examination is administered by a three-member committee assigned by the department. The chairperson of the exam committee is selected from outside the student's principal area of study, and the other two committee members may be faculty members familiar with the student's research area.

- c. A student selects an important published paper in the area related to their research with fundamental, theoretical, and/or methodological content. Students must not select a paper from their research mentor's group. A research mentor should assist the student in choosing the paper and developing an understanding and interpretation of it. The paper should represent a research topic of collaborative interest to the student and research mentor and must be approved by the selected three-person faculty evaluation committee.
- d. The student is fully responsible for understanding the content of the chosen paper, including relevant references and background source material. In addition to understanding the technical content, the student should be able to answer questions about why the paper is essential, how the authors arrived at their approach, why the results are significant, how the results compare to related work, and what could be improved.
- e. The student is not expected to propose specific research directions or demonstrate any of their own initial research results.

2) Scholastic Knowledge

To guide the assessment of the ECE Ph.D. fundamental knowledge, the following is a list of research areas in our department; each area has a list of core courses that a Ph.D. student in that area should know and be tested on by the time he/she takes the Ph.D. Qualifying Examination. When signing up for the Ph.D. Qualifying Examination, the student must specify a primary area and a secondary area and three courses to define their fundamental knowledge such that there is:

- a. Two primary courses from one of the domain areas listed below.
- b. One secondary course must be outside the primary domain area. The secondary domain area graduate-level course may be an ECE domain area, including those explicitly listed, or an unlisted related area from Math, Statistics, Computer Science, Physics, etc., upon approval from the graduate committee.
- c. A minimum of A- is required in each of the chosen primary and secondary courses.

At least one of the three courses (two primary and one secondary) must be a graduate-level ECE course.

ECE:5995 Contemporary topics in ECE for primary or secondary courses require approval by the graduate committee. To fulfill the primary course requirement, contemporary Topic courses must be closely related to the primary domain area. To fulfill the secondary course requirement, the contemporary topic must not be associated with the primary domain area.

Research Areas:

Data Science, Machine Learning, and Artificial Intelligence:

- ECE:5330 Graph Algorithms and Combinatorial Optimization
- ECE:5450 Machine Learning
- ECE:5455 Statistical Foundations of Inference and Machine Learning
- ECE:5845 Modern Databases

Medical Imaging and Image Analysis:

- ECE:5460 Digital Signal Processing
- ECE:5470 Medical Imaging Physics
- ECE:5480 Digital Image Processing
- ECE:5490 Multi-Dimensional Image Analysis Tools and Techniques

Systems:

- ECE:5460 Digital Signal Processing
- ECE:5520 Introduction to Information and Coding Theories
- ECE:5600 Control Theory
- ECE:5640 Computer-Based Control Systems
- ECE:5500 Digital Communications

Computer Systems:

- ECE:5800 Fundamentals of Software Engineering
- ECE:5810 Formal Methods in Software Engineering
- ECE:5820 Software Engineering Languages and Tools
- ECE:5840 Software Security
- ECE:5845 Modern Databases
- ECE:5320 High Performance Computer Architecture
- ECE:5525 Cryptography
- ECE:5550 Internet of Things

Electronic and Photonic Systems Engineering:

- ECE:4720 Introductory Optics
- ECE:4728 Introductory Solid State Physics
- ECE:5410 Advanced Circuit Techniques
- ECE:5415 Radio Frequency Electronics
- ECE:5420 Power Electronics
- ECE:5430 Quantum Engineering: Computing and Devices
- ECE:5700 Advanced EM Theory
- ECE:5790 Electro Optics

3) English Proficiency

At the University of Iowa, students whose first language is not English, including both U.S. and international students, must satisfy the [English Proficiency Requirement](#). The English proficiency score required for admission to the University is lower than the score required to satisfy this requirement. Students who are admitted to the University but whose English proficiency exam scores do not satisfy the English Proficiency Requirement must take the University of Iowa [English Placement Evaluation \(EPE\)](#). Depending on their score, they may be required to take up to three [English as a Second Language \(ESL\) credit courses](#). ESL courses are offered in oral skills, reading, writing and grammar, and listening. These courses are designed to strengthen students' English language skills and prepare them for successful completion of academic coursework.

Eligibility to Register for the Qualifying Examination

To be eligible to register for the Qualifying Examination, a student must satisfy all of the following requirements:

- 1) Completion of at least 15 semester hours of formal graduate coursework toward the Ph.D. degree objective (transfer credits may be included).
- 2) Completion of at least 6 semester hours of formal graduate coursework in ECE at the University of Iowa.
- 3) A minimum GPA of 3.25 in all formal graduate coursework applied toward the Ph.D. degree objective, including transfer credits.
- 4) A minimum GPA of 3.25 in all formal graduate coursework completed within the University of Iowa ECE program.

Students should take the Qualifying Examination as soon as they meet these requirements, which is usually within three semesters of entering the program.

Note: Formal graduate courses are those with a fixed syllabus, scheduled lectures, and graded assignments or exams, and are designed to provide foundational or advanced knowledge in a subject area. This excludes seminars, independent study, and thesis research hours.

Qualifying Examination: Sequence of Events

Registering for the Qualifying Examination

Students seeking Ph.D. candidacy may register for the Qualifying Examination during the first two weeks of

the semester, or during the two weeks before the end of the spring semester for a summer examination. The registration form is available from the ECE Graduate Committee.

Committee Selection

Each student's examination committee is selected by the Graduate Committee and formed by the end of the third week of the semester, or by the end of the first week of the summer term. The committee has three members. The chairperson is selected from outside the student's principal area of study, and the other two members may be faculty familiar with the student's research area. The student's research mentor will not be a member of the committee. A student may suggest and justify up to four possible committee members for consideration.

Scheduling

The student must contact the committee members and schedule a mutually convenient 90-minute timeslot. The examination must be completed no later than the second whole week in November, the second whole week in April, or the week before the start of the fall semester.

Written Report and Oral Presentation

The student submits a written report of one to three pages to the ECE Graduate Committee and to the three-member evaluation committee no later than one week before the oral examination date. The report must emphasize the background, motivation, rationale, and scope of the chosen research area and be written for a broad audience rather than for experts in the field. The student must be the sole author and must use their own words. Text may not be copied from published sources; submissions are checked for plagiarism. AI tools may not be used to perform the work of summarizing and contextualizing the paper.

The oral examination is scheduled for 90 minutes, of which approximately 20 minutes is the student's presentation. During the oral examination the student should be able to describe at least the purpose, background, method, significance, and conclusion of the chosen paper, and should expect questions in the declared primary and secondary knowledge areas as well as on background topics related to the research. Research contributions or results are not required but may be included. The student's research advisor may not be present at the oral examination.

Faculty Vote

The ECE faculty convenes three times a year to deliberate and vote on admission to Ph.D. candidacy: at the beginning and end of the fall semester, and at the end of the spring semester. The faculty reviews the examination materials (grades, written documents, and presentation slides), considers the advisor's recommendation, and reviews the three-member committee's consensus recommendation. The chair of the three-member committee submits a consensus report for distribution to the faculty at least 48 hours before the meeting. The faculty vote is pass, conditional pass, or fail, and the decision is presented to the student before the end of the semester, or within the first six weeks of the fall semester for summer evaluations.

Admission to Ph.D. Candidacy

Following the written and oral examinations, the ECE faculty evaluates the student's competence with respect to the admission criteria and votes on whether to grant or deny admission to Ph.D. candidacy. The ECE faculty may impose a set of binding requirements that the student must satisfy before being admitted to Ph.D. candidacy. In such cases, admission is contingent upon satisfactory completion of those binding requirements.

A student who does not register for the Qualifying Examination at the required time, or who registers but does not appear for the examination, is denied admission to Ph.D. candidacy and may not take the Qualifying Examination in a subsequent semester unless the student obtains permission to do so by successfully

petitioning the ECE Graduate Committee.

A student who takes the Qualifying Examination by the required time and is denied admission to Ph.D. candidacy may retake the Qualifying Examination in the following semester, provided that all requisite conditions are met during that semester. A new examination committee will be assigned for a second attempt, and the student's entire record is re-evaluated at that time. A student who has been denied admission to Ph.D. candidacy twice is no longer eligible for admission to Ph.D. candidacy.

The complete Qualifying Examination policy, including the registration form, the frequently asked questions for students, and the faculty evaluation forms, is maintained by the ECE Graduate Committee in the document ECE Qualifying Examination Policy.

Scheduling of Oral Exams

Normally, all oral examinations (MS thesis defense, PhD comprehensive, PhD thesis defense) should be scheduled during regular University academic sessions. If a thesis defense or comprehensive exam must be scheduled during an interval between academic sessions, explicit prior approval must be obtained from all members of the examining committee well in advance of the examination date.

MS and PhD Plans of Study

In order to guide graduate students toward coherent course selection, but still permit individualized tailoring of plans of study for the diversity of research interests of the discipline of Electrical and Computer Engineering, a formal filing of a plan of study is required with the following properties:

- 1) After being admitted to the graduate degree program, each student must select an advisor and formulate a Plan of Study before being permitted to register for his/her second semester. An advisory committee need not be formed at this time.
- 2) The Plan of Study will clearly specify the course requirements to be satisfied before graduation and must be consistent with other provisions of the Graduate Manual. This plan must be approved by the advisor and be placed in the student's file. The plan of study will normally designate the specific courses to be taken, but it may also include specifiers such as: "Student must complete n of the following m courses" where a list of m courses is then specified.
- 3) Changes to the Plan of Study will be allowed with the approval of the advisor. The change must be approved prior to the student taking a course not on the current Plan of Study.
- 4) Changing advisors requires consultation among the previous advisor, the proposed new advisor, and the student. The Graduate Committee must be immediately notified in the event of such a change.
- 5) All students currently enrolled in the Electrical and Computer Engineering graduate program, but not yet having satisfied the formal course requirements for their currently approved degree objective, must file a Plan of Study according to the above-stated policies.

Courses in Other Departments

Students at all levels are encouraged to strengthen their plans of study with appropriate courses in other areas such as mathematics, computer science, statistics, and physics. The advisor's assistance and approval should be sought in choosing these courses.

Graduate Colloquium

All Electrical and Computer Engineering Graduate students enrolled on a full-time basis and/or holding assistantships must enroll each semester in the course ECE:5000 (Graduate Seminar: Electrical and Computer

Engineering) for 0 semester hours of credit. Students who miss more than a third of the regularly scheduled Electrical and Computer Engineering Graduate Colloquia will receive a grade of W for this course. Exemptions to this requirement will be granted only under exceptional circumstances by the chairperson of the Electrical and Computer Engineering Graduate Committee.

Entrance Standards

The entrance standards for the Electrical and Computer Engineering Graduate Program are:

1. For the MS program a minimum GPA of 3.0 on a four-point basis is required. For the PhD program, in addition to the minimum GPA of 3.0 for the MS program, if applicable, a minimum graduate GPA of 3.25 is also required.
2. An MS student with a GPA less than 3.0, but better than 2.5 on courses in electrical and computer engineering, mathematics, and physics may be admitted on a probationary status.
3. Students with baccalaureate degrees and strong credentials in related areas (e.g., physics, mathematics, and computer sciences) may be admitted. In such cases, additional course work without graduate credit may be required.
4. All new international students must meet the minimum [English Proficiency Requirements](#) set by University of Iowa Graduate Admissions. A minimum TOEFL iBT score is required for admission. The minimum TOEFL iBT score is 81 for tests taken before January 2026 and 4.5 for tests taken after January 2026. Students with a TOEFL iBT score of less than 100 (or other test scores as listed on the [Graduate Admissions Website](#)) are required to take the English Placement Evaluation (EPE) prior to registering for classes for their first session. Any remedial courses recommended by the English as a Second Language Department must be completed at the earliest opportunity.

Probation and Dismissal

A student shall be placed on probation if the student's cumulative grade point average on graduate work done at the University of Iowa falls below 3.00 for the MS students and 3.25 for the PhD students. After one year or the completion of 8 more semester hours of graduate work at this university, whichever comes first, the grade point average will be re-examined. If it remains below the minimum requirement, the student shall be denied permission to re-register; otherwise, the student shall be restored to good standing.

Professional Training Assignments

All students in advanced degree programs are required to complete professional research and/or teaching assignments, regardless of whether they receive financial aid, before being awarded an advanced degree

Special Credit Situations

Only S (satisfactory) and U (unsatisfactory) grades shall be given in courses numbered ECE:5000, ECE:5998, and ECE:5999. Credit earned through extension and Guided Self-Study Program courses may not be applied toward satisfying course requirements unless the student was an off-campus student at the time the courses were taken.

Graduate Assistantships

In the absence of special arrangements to the contrary, every student is expected to be registered as a full-time student during each term in which the student receives an assistantship.

Exceptions

Exceptions to the regulations in this manual are allowed only on the basis of a written petition by the student and the approval of the Graduate Committee.

****Approved ECE Graduate Courses**

All formal ECE courses numbered ECE:5001 and higher are automatically on the list of the approved ECE graduate courses. In addition, the following course is also considered approved for ECE graduate courses:

- ECE:4720 Introductory Optics (cross listing of PHYS:4720)
- ECE:4728 Introductory Solid State Physics (cross listing of PHYS:4728)
- Contemporary Topics courses (ECE:5995 and ECE:7995) with different content may be counted more than once. All courses used to meet the ECE semester hour total must be taken for a letter grade (not S/U).

^^ Guidelines for graduate approved course credit

In addition to the approved ECE graduate courses**, courses from other departments may be taken to fulfill graduation requirements. To obtain credit toward your graduate degree, all of the following criteria must be met:

1. The course must be accepted as a graduate level course for majors in the home department from which it is offered.
2. All courses used to meet the semester hour total must be taken for a letter grade (not S/U).
3. The course must contribute to a coherent focused training program acceptable to the advisor and approved by the Graduate Committee. For example, graduate level courses in other engineering, computer science, math, or physics departments that support your coherent training program are appropriate for graduate course credit.

In rare circumstances courses not meeting the approved ECE graduate course** or graduate approved course^^, requirements may be requested on the basis of a written petition by the student and approval of the Graduate Committee.