



ECE ELECTRICAL &
COMPUTER ENGINEERING
UNIVERSITY OF MICHIGAN

ECE GRADUATE PROGRAM MANUAL

**Effective for students starting
Winter 2023
or later**

**EECS BUILDING
1301 Beal Ave
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www.eecs.umich.edu/eecs/graduate**

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1. INTRODUCTION

The Electrical and Computer Engineering Graduate Program Manual provides information on the requirements for the Master of Science (MS), Master of Science in Engineering (MSE), and Doctor of Philosophy (PhD) degrees. The Electrical and Computer Engineering Graduate Program is one of two graduate programs comprising the Electrical Engineering and Computer Science Department (EECS) at the University of Michigan. Each of the two programs, Computer Science Engineering and Electrical and Computer Engineering have their own areas of research and courses. Students enrolled in Electrical and Computer Engineering are primarily interested in the area of Electrical Engineering, Systems Science, and Computer Engineering.

The Electrical and Computer Engineering Program is part of the University of Michigan's Horace H. Rackham School of Graduate Studies. The Rackham Graduate School publishes the Graduate School Academic Policies with regulations that apply to all graduate students. Electrical and Computer Engineering students should consult both this Manual and the Rackham Academic Policies. Please click here for Rackham Academic Policies:

<https://rackham.umich.edu/academic-policies/>

For the remainder of the manual, "Master's Program/degree" refers to both the Master of Science and Master of Science in Engineering degrees.

Major Areas

The Electrical and Computer Engineering Program offers these twelve major areas of concentration:

- Applied Electromagnetics & RF Circuits
- Computer Vision
- Control Systems
- Embedded Systems
- Integrated Circuits & VLSI
- MEMS & Microsystems
- Network, Communication, and Information Systems
- Optics & Photonics
- Power & Energy
- Robotics
- Signal & Image Processing and Machine Learning
- Solid State & Nanotechnology

Please note: Major areas may also be called sub-plans, specializations, technical areas, or research interest.

2. ADMISSION

Admission to the ECE Graduate programs is through the Rackham Graduate School. Please click [here](#) for additional information regarding applying:

<http://ece.umich.edu/gradapply/>

It is the responsibility of the applicant to make sure the ECE Graduate Program receives the completed application form by the specified deadlines.

Students desiring admission to the Master's and PhD Program should have earned a bachelor's degree in engineering, mathematics, or physical sciences. Admission to the Master's and PhD Program requires a completed application, transcripts of all previous academic records, three letters of recommendation, academic statement of purpose, and personal statement. In addition, GRE scores are required for the Master's program from applicants who have graduated or will graduate with an undergraduate degree from a non-US institution, GRE scores are not required from applicants who have graduated with an undergraduate degree from a US institution. GRE scores are no longer included in the admissions process for the PhD program.

Students who enter with an undergraduate electrical engineering degree have a choice of either the Master of Science (MS) or Master of Science in Engineering (MSE) degrees. Students who enter without an undergraduate electrical engineering degree receive a Master of Science degree.

PhD students admitted without a master's degree may complete the master's requirements as they progress through the PhD Program.

Current UM undergraduates in EECS may be eligible for the Sequential Graduate/Undergraduate Study (SGUS) or 3.4 programs. These programs allow students to waive some of admission application requirements for the Master's Program. See the ECE MS Graduate Coordinator or the website for additional information: <https://ece.engin.umich.edu/academics/graduate-programs/prospective-grad-students/graduate-school-for-u-m-ug-students/>

Current UM graduate students in other programs may be eligible to earn a dual degree in ECE. Adding an additional ECE Master's degree requires a completed "Add a Degree" application, a letter of recommendation from research advisor, UM transcript, and Master's degree plan of study. Go to the ECE Graduate Program Office or website for additional information.

3. GENERAL ACADEMIC POLICIES

Cognate Course Requirement

The Rackham Graduate School requires PhD students to complete coursework outside of their major research/interest area. PhD students must complete at least three credits to meet this requirement. Only letter-graded graduate-level courses may be used to meet this cognate requirement.

Any graduate-level course outside of the EECS department not being used as a Major Area course meets this requirement. Non-cross-listed EECS courses may be counted as a cognate if they are without* an M or E in the entire row for the course on the ECE Course List (<https://ece.engin.umich.edu/academics/course-information/graduate-course-list/>). Also, cross-listed courses within the EECS department are allowable unless they are already part of the student's major area.

Course Withdrawal

Courses dropped after the 3rd week of the registration period will receive a "W" on transcript.

After the eighth week of a full term (fourth week of a half term), courses may be dropped or changed to Visit/Audit status only under exceptional circumstances and with the approval of the course instructor, advisor, and the ECE Associate Chair of Graduate Affairs.

You cannot remove courses from your transcript.

Term-specific deadline dates are posted in the ECE Graduate Program Office and website.

Dual Degree and Certificate Programs

ECE students have the ability to obtain Master's degrees or graduate certificates in other programs at UM. Adding a Master's degree or graduate certificate may require additional coursework and semesters to a student's time at UM. In addition, there is a limit to how many courses can be counted towards the original Master's degree and the added Master's degree or graduate certificate. Adding graduate certificates can only be done if the student is currently enrolled in a Master's or PhD program.

Students interested in pursuing these options must contact the graduate program(s) of interest to find out the requirements to add the degree.

English Proficiency

Based on English language proficiency test scores (such as the TOEFL), some students will be encouraged by the Rackham Graduate School to take specific academic writing or speaking courses offered by the English Language Institute (ELI) to support their studies. The ELI courses are typically 1 to 3 credits, and will help students gain capability and confidence in English. These courses will not count toward the degree or GPA.

A student's English proficiency is also evaluated as the PhD student participates in the oral Qualifying Exams and Research Thesis Proposal presentation. If the faculty considers the student to otherwise be qualified for the ECE PhD program, it may be recommended that the student take English courses. Students with major deficiencies in English will be found Not Qualified for the ECE PhD Program.

Enrollment Status

Regarding courses:

Full-time enrollment is 8 credit hours.

For GSI/GSRA, full time enrollment is 6 credit hours. SUGS students must be enrolled in 9 credits, even if GSI/GSRA.

ELI courses count towards enrollment status.

Visit/Audit of a class does not count towards enrollment status.

Regarding tuition:

For 1-8 credits, a student's account is charged an amount for each credit hour.

For 9+ credits, a student's account is charged a single amount for all credits.

Grades and GPA Requirement

All grades are on the Rackham Graduate School scale:

A+	4.3	B+	3.3	C+	2.3	D+	1.3
A	4.0	B	3.0	C	2.0	D	1.0
A-	3.7	B-	2.7	C-	1.7	D-	0.7

Course grade must be B- or better for the credit hours to be counted toward any degree requirement.

The grade point average (GPA) must be at least 3.0, based on Rackham's 4.0 scale. A cumulative GPA below a 3.0 will cause the Graduate School to place a notation of "unsatisfactory academic standing" on the student's academic record.

A student with unsatisfactory academic standing will not be granted a degree, and may change programs and transfer credits only with permission of the admitting program.

COVID Policies

Due to the pandemic an amended grading structure for Winter 2020, Fall 2020, and Winter 2021 has been implemented. In Winter 2020, all grades were masked, with grades of B- or above masked to S and grades C+ and below masked to NRC (No Record COVID), unless unmasked by student request. In Fall 2020 and Winter 2021, grades were issued, with grades C+ and below automatically masked as NRC. Students could elect to mask grades B- or above to S within a time-frame specified by Rackham Graduate School.

Courses where the letter grade had been masked to an S will count towards the graded course program requirements. As ECE has a minimum B- grade requirement for courses, any courses masked with an S will have a sufficient letter grade to count. NRC courses will not be counted towards degree requirements.

A student must have at least one unmasked course in order to graduate so that a GPA can be calculated.

Graduation

Graduation for the Master's or PhD degree is not automatic. A student who has completed the degree requirements must submit a completed plan of study via <https://deptapps.engin.umich.edu/planstudy/student?dept=216002> as well as apply for graduation via the Wolverine Access System.

The last day to apply for graduation for the current semester is the last day of classes (not the final exam period).

Honor Code

All engineering programs at the University of Michigan follow the College of Engineering Honor Code outlining certain standards of ethical conduct. The Honor Council investigates reported violations of the Honor Code. Read more about the policy here:

<http://elc.engin.umich.edu/wp-content/uploads/sites/19/2019/03/Honor-Code-Pamphlet-2018.pdf>

International Students

Curricular Practical Training (CPT) for F-1 Students

The intent of CPT is for students to engage in practical job experience that directly relates to their academic program of study. Students must choose their internships carefully with the understanding that any job that is NOT specifically related to the applicant's major area of study, will likely result in the denial of the CPT request.

Students who want to enroll in CPT should go to <https://ece.engin.umich.edu/academics/graduate-programs/current-grad/grad-internships/> for the CPT instruction form and complete all necessary paperwork.

Credit for CPT (ENGR 998) may not be counted toward any ECE degree requirements.

Optional Practical Training (OPT) for F-1 Students

OPT is defined in the Federal Regulations as temporary employment directly related to a student's field of study. During OPT, a student remains in F-1 status. The end result of the

OPT request process is an Employment Authorization Document (EAD) issued by United States Citizenship and Immigrations Services (USCIS).

Processing OPT applications typically requires 60 to 90 days.

Some STEM students may be eligible for a 17-month extension of OPT.

Reduced Course Load (RCL) for F-1 Students

International students who drop below full time status, or who need fewer than 8 credits to complete their program requirements, may apply for RCL through the International Center.

Students who want/need an RCL can request the letter on their final plan of study.

Please note that students are eligible for RCL only if they have not yet completed their degree requirements. Due to Federal regulations, students must apply for their degree in the semester in which they complete their degree requirements. If a student wants to remain in the country after completing their requirements, they must apply for OPT. For further information: <http://internationalcenter.umich.edu>

Petition for Waiver or Modification of Policy or Requirement

A student may request special permission to adjust the departmental degree requirements or guidelines for a specific reason or circumstances. It is recommended that the student seek the advice of their academic/research advisor before submitting the petition.

A student petitioning for waiver or modification of policy or requirement must complete the Petition Request Form. The student's academic/research advisor must approve this request, and then it is submitted to the ECE Graduate Academic Affairs Committee for final approval.

Link to ECE Petition form: <https://ece.engin.umich.edu/academics/graduate-programs/current-grad/petition-requests/>

4. MASTER'S DEGREE REQUIREMENTS

The goals of the ECE Master's Program are to provide students with advanced technical knowledge to better prepare them for careers in industry and/or to provide them the technical foundation that will enable them to better understand the current technical literature in order to better perform research. Accomplishing these goals requires some depth of expertise in an area of focus as well as some breadth both within ECE disciplines and beyond.

To receive a Master's degree, a student must satisfy the ECE Graduate Program requirements outlined below as well as the Rackham School of Graduate Studies General Master's Degree Requirements as stated in the Rackham Graduate School Academic Policies and the College of Engineering Regulations as specified in the College of Engineering Bulletin.

Master's Degree Credit Distribution/Coursework

The Master's degree requires a minimum of 30 graduate level credit hours with the following distribution:

- ≥ 30 graduate level credit hours
 - ≥ 24 credits of technical graded courses
 - ≥ 12 credits of ECE* courses 500 level or higher
 - ≥ 9 credits in an ECE major area
 - ≥ 6 of these credits at 500 level or higher (will count toward your 12 cr. of ECE 500 level or higher requirement)
 - **Optional**
 - ≤ 6 credits of S/U graded courses
 - ≤ 3 credit of seminars/courses that are not directed study
 - ≤ 6 credits of directed study

*The Link to ECE Major Area Course List:

<https://ece.engin.umich.edu/academics/course-information/graduate-course-list/>

Master's students wishing to change major areas must pass at least two courses within the major area to which they were admitted before changing area. A change of area must be approved by the area advisor for the proposed new major area.

All course requirements must be letter-graded (A, B, etc.) and may not be marked as satisfactory/unsatisfactory except for the optional requirements.

Technical courses are generally courses from Engineering, Math, Statistics, Physics, and other science disciplines. The academic advisor must approve courses from Economics, Business, etc. Entrepreneurship courses and AERO 585 are not technical courses. Three credits of either EER 601 or 602 can be counted as technical graded courses.

AERO 585 can be counted towards ECE degree requirements once.

Courses that do not count toward Master's degree requirements:

- Math 404, 417, 425, 448, 450 and their cross-listed courses may not be counted for any degree requirements.
- Courses with number 990, 995 or other course with "doctoral," "dissertation," or "preliminary" in the title may not be counted towards Master's degree requirements.
- Course pairs not allowed in individual areas, e.g., EECS 455/554, due to overlap in content between the two versions.
- ENGR 998 (Curricular Practical Training) may not be counted for any degree requirements.
- ELI courses cannot count towards degree requirements.
- Courses with insufficiently advanced content and level, or which substantially duplicate in content and level courses already completed by the student.

Master's Degree Plan of Study

The MS Plan of Study is a form that maps out which courses satisfy specific degree requirements. It is required that students submit a plan of study, approved by their corresponding Academic Advisors, at the beginning of the first term, within a month after the beginning of their first semester. Failing to do so will risk the student's ability to register the following semester.

It is also required that a student get pre-approval from their Academic Advisor or the Graduate Coordinator on a revised Plan of Study each time they wish to make changes to it. Failing to do so will risk the student's ability to graduate with a Plan of Study that had not been pre-approved. It is highly recommended that students meet with their academic advisors to discuss the plan at the beginning of each term.

Link to MS Plan of Study:

<https://deptapps.engin.umich.edu/planstudy/student?dept=216002>

Please Note: It is the responsibility of the student to submit to the ECE Graduate Program Coordinator an updated, approved final MS Plan of Study when applying for graduation. Failure to submit the MS Plan of Study timely could delay graduation.

Master's Degree Thesis Option

The option of writing a Master's thesis is available to ECE Master's students in good academic standing.

A student wishing to exercise this option may initiate the process through these steps:

1. Find an EECS faculty member willing to serve as the Thesis Advisor; the Thesis Advisor is responsible for supervising the work of the Master's thesis project.
2. Enroll in the Master's thesis course for one to six credits.
3. Complete the Thesis Proposal form. It's the same form the PhD students use.
4. Arrange for a Master's Thesis Committee to be approved by the ECE Graduate Program Chair.
 - o The Master's Thesis Committee will consist of the Thesis Advisor, as chair, and two additional faculty members.
 - o At least two of the thesis committee members must be ECE tenure-track faculty with more than a 0% ECE appointment.
 - o The committee members will be available for consultation and will evaluate the thesis.

The student must satisfactorily complete the Master's thesis course (EECS 698) for a maximum of six (6) credits. These credits may be spread over more than one term. The course may be taken for one to six credits per term on an S/U basis.

The student must write a report that is substantially consistent with the Rackham format for theses. Each member of the Master's Thesis Committee must submit a written evaluation of the thesis. Approval of the thesis by all committee members is required. In addition to the thesis, the Master's Thesis Committee may request an oral report.

The student must elect the thesis option within thirteen months of first enrolling in the Master's program. The thesis must be completed within twelve (12) months of the initial election of the thesis course.

Students choosing the Master's thesis option may apply at most an additional 3 credits of research, seminar, or directed study credits towards the ECE Master's degree, and the required number of credits in graded graduate technical courses is reduced from 24 to 21.

Master's Degree Timeline

The timeline below displays a "typical" Master's student progress in our program in 3 or 4 semesters. Students must complete all work for the Master's degree within five years from the date of first enrollment in the program. Those exceeding this limit must petition Rackham for a time extension or be withdrawn from the program.

Academic Term	Coursework	Research Activities (optional)	Milestones
Year 1: Fall	8-9 credits	Search for a research advisor	≥3.0 GPA
Year 1: Winter	8-10 credits	Choose research advisor for Master's thesis or to transition to PhD program.	≥3.0 GPA
Year 1: Sp/Su		Independent study or Master's thesis research	
Year 2: Fall	8-11 credits	Independent study or Master's thesis research	≥3.0 GPA; (Apply for graduation)
Year 2: Winter	3-6 credits	Independent study or Master's thesis research Complete Master's thesis written report	≥3.0 GPA; (Apply for graduation)

Transfer of Credit

Students who want to transfer credits must follow the Rackham Transfer of Credit guidelines:

- A student is allowed to transfer up to 6 credits from external institutions or 15 credits can be transferred from within the University of Michigan.
- These credits must be used in whole and cannot be split (e.g., only use 2 of the 4 credits).

To transfer credits:

- Student must complete 8 credits of graded graduate courses at the University of Michigan to transfer credits.
- Student must have a minimum GPA of 3.0.

Transfer credits must meet the following criteria:

- Be a graduate level course
- Receive a “B” grade or higher
- Cannot have been used to satisfy degree requirements for undergraduate or graduate degree. (In other words, they must be extra credits taken)

Link to Transfer Credit form: <https://ece.engin.umich.edu/academics/graduate-programs/current-grad/transfer-credits/>

Applying to PhD Program

Current MS students interested in the ECE PhD program must apply by following the Rackham application process. Such students are strongly encouraged to get involved in research with a faculty before applying. Current MS students who apply to the PhD program without having first formed a research relationship with a potential PhD advisor are rarely admitted.

5. PHD DEGREE REQUIREMENTS

Relevant Master’s Degree

If a student entering the PhD Program already has a Master’s degree, it is determined at the time of admission whether the Master’s degree coursework is sufficiently similar to the ECE Master’s degree requirements/coursework. If so, the coursework is deemed to be relevant. Master’s degrees in Electrical Engineering, Electronics Engineering, Electrical and Computer Engineering and Electrical Engineering: Systems are considered to be relevant.

Embedded Master’s Degree

Students who enter the PhD Program without a relevant Master’s degree are not automatically enrolled in the ECE Master’s Program. To add the Master’s degree, students need to indicate on their candidacy plan of study, that they would like a Masters to be added to their studies.

PhD Degree Credit Distribution/Coursework

1) *Without a relevant Master’s degree*, a student must complete a minimum of 36 graduate level credit hours with the following distribution:

- ≥ 36 graduate level credit hours
 - ≥ 30 credits of technical graded courses
 - ≥ 12 credits of ECE courses 500 level or higher
 - ≥ 9 credits in an ECE major area
 - ≥ 6 of these credits at 500 level or higher (will count toward your 12 cr. of ECE 500 level or higher requirement)
 - ≥ 3 credits of graded cognate area (may count toward your technical course requirement)

- **Optional**
 - ≤ 6 credits of S/U graded courses
 - ≤ 3 credit of seminars/courses that are not directed study
 - ≤ 6 credits of directed study

2) *With a relevant Master's degree*, a student must complete a minimum of 18 graduate level credit hours with the following distribution:

- ≥ 18 graduate level credit hours taken at UM Ann Arbor
 - ≥ 6 credits of graded technical courses
 - ≥ 3 credits of graded cognate courses (can be satisfied with course equivalency but will not count toward the 18 cr. requirement)
 - ≥ 6 credits of graduate level courses approved by the research advisor (including directed study)

Note:

- There is no additional "major area" requirement here for the extra 6 credits -- just advisor approval.
- Technical courses are generally courses from Engineering, Math, Statistics, Physics, and other science disciplines. The academic advisor must approve courses from Economics, Business, etc.
- Three credits of either EER 601 or 602 can be counted as technical graded courses.

Courses that do not count toward PhD degree requirements:

- Math 404, 417, 425, 448, 450 and their cross-listed courses may not be counted for any degree requirements.
- Courses with number 990, 995 or other course with "doctoral," "dissertation," or "preliminary" in the title may not be counted towards master's degree requirements.
- Course pairs not allowed in individual areas, e.g., EECS 455/554, due to overlap in content between the two versions.
- ENGR 998 (Curricular Practical Training) may not be counted for any degree requirements.
- ELI courses cannot count towards degree requirements.
- Courses with insufficiently advanced content and level, or which substantially duplicate in content and level courses already completed by the student.

Link to ECE MS Major Area Course List:

<https://ece.engin.umich.edu/academics/course-information/graduate-course-list/>

PhD Degree Plan of Study

Students develop a PhD Plan of Study in conjunction with their academic or research advisor(s). The plan of study can be changed as the student progresses through the program. The PhD Plan of Study must satisfy the following requirements and be approved by the student's research advisor(s).

The PhD Plan of Study must satisfy all Rackham coursework requirements (including GPA, residency, and cognate requirements). For further information:

<https://rackham.umich.edu/academic-policies/section4/>

Link to PhD Plan of Study:

<https://deptapps.engin.umich.edu/planstudy/student?dept=216002>

Course Equivalency

If a student has taken a course elsewhere that is “substantially equivalent” to an EECS course, it may not be necessary to retake the course. The student should consult with their academic and/or research advisor at the earliest opportunity to determine whether or not equivalency is appropriate.

Students entering with a Master’s degree must submit a Course Equivalency Form as part of the planning and advising process at the beginning of their first term in the graduate program.

For course equivalency approval, additional supporting documentation is required such as syllabus, course description, homework, etc.

Link to Course Equivalency Request form:

<https://ece.engin.umich.edu/wp-content/uploads/sites/4/2019/08/ECE-Equivalency-Request.pdf>

Academic Probation/Dismissal

Continued enrollment and guaranteed financial support is contingent upon satisfactory academic and research progress by the student.

Student evaluations are conducted annually via a Progress Report at the end of the winter term. Evaluations can also be initiated by the student’s advisor at any time. Submission of the Progress Report during an evaluation is mandatory. The student and their research advisor will both complete and sign the Progress Report.

This report will identify one of three possible outcomes:

- Satisfactory
- Concerns
- Unsatisfactory

Failure to submit the Progress Report may lead to a rating of ‘Unsatisfactory’. When a student’s progress is deemed to be ‘Concerns’ or ‘Unsatisfactory’, another Progress Report will have to be submitted after an interval determined by the Graduate Chair of no less than two months. If

progress is still deemed to be insufficient, the student advisor or Graduate Chair may recommend that the student be placed on Academic Probation.

A student who voluntarily chooses to leave their advisor but has not acquired a new advisor, or a student who has not met a Program-mandated deadline to find an advisor, can be recommended for Academic Probation at the discretion of the Graduate Chair.

An Academic Probation Committee consisting of three faculty members will then be formed by the Graduate Chair. This committee will determine by majority vote whether the student is to be placed on Academic Probation. The Graduate Chair will notify the student and Rackham in writing before the probationary period begins, explaining the reasons and conditions of probation; the start and end dates of the probationary period; funding support; conditions, if any, for returning to satisfactory standing; and options for appeal.

The probationary period may be no shorter than two months. For a student placed on probation within two months of the end of the fall term, the probationary period will extend into the winter term for a total of at least two months. For a student placed on probation within two months of the end of the winter term, the probationary period may include the spring or summer half-terms or the following fall term, for a total of at least two months. A student may be placed on probation starting in the spring or summer half term for a minimum of two months, and does not need to be enrolled during these half terms. A student with guaranteed financial support will continue to be funded while on probation.

A student who has been placed on probation may request a leave of absence from Rackham or withdraw. The leave or withdrawal will stop the clock on the probationary period, which resumes when the student returns to active status or is reinstated. Probation will remain in effect until the conditions are remedied or the student is dismissed.

At the end of the probationary period, and upon the recommendation of the Graduate Chair and the consent of the Graduate School, a student may either be returned to good academic standing or dismissed from the program. Dismissal will occur by a majority decision of the Academic Probation Committee. The Graduate Chair will notify the student and Rackham in writing of the dismissal decision. A student with guaranteed financial support will continue to be funded until the end of the term in which Dismissal occurs, and will have at least one month of funding after Dismissal.

Students may appeal the Academic Probation or Dismissal decision. In this case, the Graduate Chair will form a new committee with three faculty members, none of which are members of the original Academic Probation Committee. This committee will either confirm or overturn the Dismissal decision by a majority vote. Students may use the Graduate School's Academic Dispute Resolution process only for procedural issues of fair and equal treatment under the policy of the program, and not to appeal the academic reasons for the decision.

Students who fail to meet standards of academic or professional integrity or who have been found responsible for violations of other University standards of conduct may be dismissed in accordance with separate procedures described in Rackham Academic and Professional Integrity Policy:

<https://rackham.umich.edu/academic-policies/section8/>

PhD Degree Deadlines

Number of full semesters (Fall & Winter) after entry by which milestone should be completed		
Milestone	Enter without relevant Master's	Enter with relevant Master's
Master's degree coursework	4	N/A
PhD degree coursework	6	3
Qualification Exam	4	3
Candidacy	4	3
Thesis Proposal	6	5
Thesis Defense	9 - 12	7 - 10

A student may be given 4 additional months/1 term to complete each milestone with approval from their Research Advisor and the Graduate Program Chair.

Students must complete any remaining credits after achieving Candidacy and prior to giving their Thesis Proposal.

PhD Degree Timeline

Below is the typical timeline for the PhD student. The PhD is unique to each student due to the nature of research and is subject to greater flexibility in timing.

Nevertheless, the ECE Program expects the majority of students to complete the PhD degree in no more than five years. Students who take longer than five years (4 years with a relevant Master's) to complete the PhD degree may lose financial support.

The Rackham Graduate School allows up to 7 years from the first term of enrollment. Students who do not complete the PhD degree in 7 years must submit a petition to Rackham requesting an extension.

Academic Term	Coursework	Research Activities	Milestones
Year 1: Fall	2-3 courses	Departmental and area research seminars, Faculty/student research meetings	≥3.0 GPA
Year 1: Winter	2-4 courses	Departmental and area research seminars, Faculty/student research meetings	≥3.0 GPA
Year 1: Sp/Su			Identify a topic for Qual research project, begin preliminary readings and a preliminary problem statement
Year 2: Fall	2-3 courses Directed research, prepare for Qual Exam	Faculty/student research meetings in area of interest, directed research with research advisor	≥3.0 GPA, refine the problem statement and begin research, prepare for Qual Exam
Year 2: Winter	2-3 courses + directed research, take Qual Exam		≥3.0 GPA, *Expected* to take the qualifying exam in January (1 st attempt). Achieve Candidacy at the end of Winter term, complete master's degree requirements and apply for master's degree
Year 2: Sp/Su			Final attempt to retake the Qual Exam in May. Continue/begin research for Thesis Proposal
Year 3: Fall	EECS 995 + 1 course (max), if already a candidate	Research with research advisor, faculty/student research meetings in other areas of interest	Problem formulation, preliminary readings and derivations for PhD Thesis Proposal
Year 3: Winter	EECS 995 + 1 course (max)	Research with research advisor, faculty/student research meetings in other areas of interest	Problem statement, refinement, form dissertation committee and present a Thesis Proposal
Year 3: Sp/Su		PhD research	
Year 4: Fall	EECS 995 + 1 course (max)	PhD research	Update dissertation committee on research progress (at least once during the academic year)

Year 4: Winter	EECS 995 + 1 course (max)	PhD research	Update dissertation committee on research progress (at least once during the academic year)
Year 4: Sp/Su		PhD research	
Year 5: Fall	EECS 995 + 1 course (max)	PhD research	Update dissertation committee on research progress (at least once during the academic year)
Year 5: Winter	EECS 995 + 1 course (max)	PhD research	Final defense of dissertation before dissertation committee, complete any dissertation revisions, graduate with PhD

Qualification Examination

In addition to course/credit requirements, must pass the PhD Qualification Exam.

Goals of Qualification Exam process:

- Encourage students to engage in research in their first 16 months of graduate study, while working on degree coursework requirements, e.g., reading literature, learning experimental methods and/or analysis methods, learning to identify important problems and develop solutions independently, presenting ideas orally and in writing.
- Promote dialog between students and multiple faculty members about their research well in advance of preparing a thesis proposal.
- Prepare students to answer questions about assumptions, methods, problem importance, related literature, etc.
- Assess students' fundamental technical knowledge from coursework, including their ability to synthesize material across course topics and to apply it to their research.
- Maintain consistent standards within ECE about qualification for candidacy.

Qualification Exams are offered during a two-three week period near the beginning of the Fall (September), Winter (January) and Spring/Summer (May) terms. The student must submit a Qualifying Exam Application and a written report of the Research-Oriented Directed Study.

Research-Oriented Directed Study

In advance of the exam, the student will submit to the ECE PhD coordinator a written report based on their directed study (EECS 599 or 699). The report should be equivalent in content and quality to at least a four-page conference publication plus sufficient background material to convey the big picture to an examiner outside the immediate area of the student.

Scheduling & Content

The PhD qualifying exam will consist of separate 60-90 minute exams with each individual examiner. Students should be prepared for the following components of the exam:

- A prepared presentation (using slides, typically) of the directed study that would last 15-20 minutes (if uninterrupted) typically including an overview accessible to non-specialists, methods, preliminary results, and possible future plans. During and after this presentation the examiner may ask questions related to the research and its foundations. Students should also be prepared to explain their directed research.
- Oral questions emphasizing coursework-related material in four relevant ECE courses as indicated on the student's Qualifying Exam Application. The student's research advisor must approve the four courses.

Examiners

The Graduate Program Chair will select four faculty members to examine each student. The student's research advisor and co-advisor(s) are ineligible. Typically the Graduate Program Chair will select at least one examiner who is not in the student's immediate area of research focus.

Timing

The timing of the exam depends on the student's status prior to starting as a PhD pre-candidate at UM, as shown in the following table that lists months from the time of first enrollment as a pre-candidate in the ECE doctoral program. Students are strongly encouraged to take the Qualification Exam at the earliest possible date, in consultation with their research advisor, so that they are more likely to have a second try if needed. A second chance is not guaranteed.

	<u>Suggested</u>	<u>Last chance</u>
BS (or non-relevant Master's)	17 months (Jan. Quals)	21 months (May Quals)
Relevant Master's	13 months (Sept. Quals)	17 months (Jan. Quals)

Decision

A qualifying decision meeting comprised of all ECE faculty members will be held. A decision on the qualification status of each student under consideration will be made by majority vote of the convened faculty based on the examining committee's evaluations and recommendations, the student's performance in coursework and the research (co-) advisor's written and verbal input. Abstention votes will not be considered when tallying votes, as if the voter were absent. Faculty with >0% ECE affiliation are eligible to vote. Other faculty who are (co-) advisors of students taking quals may attend and give written and verbal input.

Possible decisions are:

- Qualified for the Doctoral Program.
 - Students with minor deficiencies in English proficiency may be required to satisfactorily complete certain English language courses.
- Not qualified for the Doctoral Program but allowed to retake the qualifying examination.
 - This will not apply to students who take Quals at the last chance in the Table above or who have already taken Quals twice.
- Not qualified for the Doctoral Program.

Candidacy

Completing the coursework required for Candidacy status takes place parallel to the Research-Oriented Directed Study. Rackham expects students to achieve candidacy no later than three calendar years after their first enrollment in their doctoral program. A student who does not achieve candidacy within three years will be placed on Academic Probation, unless the ECE Graduate Program petitions Rackham to request additional time because of extenuating circumstances.

Requirements

- 1) Satisfy the following coursework requirements:
 - a) For students entering with a BS degree: have completed the “Master's Degree Coursework Requirements” given above (30 credits).
 - b) For students entering with a relevant Master’s degree: have completed the 18 residency credits required by Rackham. These credits can include S/U graded courses such as EECS 599. Through a combination of letter graded and S/U graded courses, a student with a relevant Master’s should be able to satisfy the coursework requirements for candidacy in two semesters.
 - c) Be in satisfactory academic standing.
- 2) Pass the ECE Qualifying exam.
- 3) Satisfy all Rackham candidacy requirements (including GPA, residency, etc.). Click here for further details:

<https://rackham.umich.edu/academic-policies/section4/>
- 4) Candidacy is not automatic; once all ECE and Rackham requirements are met, a student must apply for candidacy by submitting the appropriate forms, including a PhD Plan of Study approved by the student’s PhD advisor(s).
- 5) Complete the College of Engineering’s Responsible Conduct of Research and Scholarship program. This program consists of 4 distinct workshops, all 4 workshops must be completed. For further information and to register for workshops: <http://rcrs.engin.umich.edu>

For satisfactory progress, a student must meet the candidacy coursework requirements by the end of their 4th semester as a pre-candidate, and pass the qualifying exam by the end of their 21st month (typically in May of their second academic year) as a pre-candidate.

Link to PhD Plan of Study: <https://deptapps.engin.umich.edu/planstudy/student?dept=216002>

Course Enrollment

Once a student has attained Candidacy status, they will enroll in 8 credits of EECS 995 each term. Tuition reduces to the Candidacy rate.

In addition to EECS 995, candidates may elect one course per term without paying tuition beyond candidacy tuition. This course may be taken for credit or as a visit (audit). A student who does not elect a course during a term of EECS 995 enrollment may elect two courses in the next term of EECS 995 enrollment; no more than one course may be deferred in this manner (an additional course may not be taken in anticipation of taking none in a future term of EECS 995 enrollment). Candidates who choose to take more courses than those for which they are eligible with candidacy tuition will be assessed additional tuition per credit hour.

It is the student's responsibility to cover the tuition costs for any courses taken in addition to the free course described above, even if the student is being funded through a fellowship, GSI or GSRA position.

Research Thesis Proposal

After passing the Qualifying Exam, a student continues to work with their Research Advisor(s) who become(s) the Dissertation Committee Chair(s). The student will write a concise Research Thesis Proposal and give a formal oral presentation of the work to the Dissertation Committee. The primary role of the Dissertation Chair(s) is to guide the student toward completion of the PhD and assist the student with forming their Dissertation Committee.

When the student is ready to complete the Research Thesis Proposal, the student must complete the following:

1. Submit the Research Thesis Proposal Form to the ECE Graduate Program Coordinator.
2. Submit a final plan of study to the ECE Graduate Program Coordinator.
3. Schedule an oral presentation with the Dissertation Committee.
4. Submit the written thesis proposal to the Dissertation Committee at least two weeks in advance of the oral presentation.

Link to Thesis Proposal/Dissertation Committee form: <https://ece.engin.umich.edu/wp-content/uploads/sites/4/2019/09/ECE-Thesis-Proposal.pdf>

During the Thesis Proposal presentation, the student should:

1. Precisely identify and describe the area of research.
2. Demonstrate an in-depth understanding of the area, including mastery of the literature on the subject area.
3. Give a general description of the research problem to be addressed.
4. Provide an outline of the methodology to be utilized.

During and after the Thesis Proposal presentation, the Dissertation Committee will explore the proposed research with the student in order to provide guidance and make an evaluation of its suitability. The committee will determine if the student has or does not have an acceptable proposal.

Failure to have an acceptable proposal requires revising the proposal and scheduling another formal oral presentation to the committee. If the proposal is not acceptable, the student has twelve months to prepare and present a satisfactory proposal.

Students entering the PhD Program without a relevant Master's degree must write and orally present the Research Thesis Proposal within 36 months of entry. Students entering with a relevant Master's degree must present within 30 months.

Dissertation Defense

In collaboration with the Dissertation Chair(s), the student forms a Dissertation Committee following specific guidelines regarding the composition of the Committee. An ECE PhD student's dissertation committee first must satisfy Rackham's Guidelines for Dissertation Committees: <http://www.rackham.umich.edu/current-students/dissertation/committees>

Dissertation Committee formation rules

The following rules apply to students in the ECE PhD program:

1. The committee must consist of four or more members; at least two of the members must be affiliated with the ECE program.
2. The Research Advisor (or Co-Advisors) will serve as Chair (or Co-Chairs) of the committee. The Chair, or at least one of the Co-Chairs, must be affiliated with the EECS Department. Affiliation means 0% or more appointment in EECS.
3. One of the Committee members must be designated as "cognate member." Cognate members must be a tenured-track faculty in a Rackham graduate program.
 - a. Faculty with 0% affiliation in ECE (including CSE faculty without an ECE affiliation) may serve as cognates for ECE thesis committees.
 - b. Faculty having more than 0% ECE affiliation (including CSE faculty with more than 0% ECE affiliation) may not serve as cognates for ECE thesis committees.
4. The ECE Graduate Program Chair must approve the thesis committee.

Dissertation Progress Reviews

Once the student has successfully presented the Research Thesis Proposal, the student should meet informally (or formally at the discretion of the Dissertation Chair). The student should meet with the Dissertation Committee at least once per year. During these meetings, the committee will determine if the student is making satisfactory progress toward finishing the dissertation. The committee, at the request of the Dissertation Chair, will report to the ECE Graduate Committee if the student is not making satisfactory progress. After two consecutive unsatisfactory progress reviews, the ECE Graduate Committee may terminate the enrollment of the student in the ECE doctoral program.

Final Defense

Each PhD Candidate must prepare a dissertation, giving evidence of their ability to conduct original, advanced research and to present the results of that research in well-written form. The student must also defend their work orally in an open examination called the Final Defense.

A final and complete copy of the written dissertation must be given to each member of the Dissertation Committee at least 17 business days before the scheduled date of the Final Defense to allow sufficient time for a written evaluation. The Final Defense will only be held if the committee deems the dissertation acceptable. Once all members of the Dissertation Committee find the dissertation acceptable, the Final Defense is held.

Course Enrollment

The student must be enrolled in 8 hours of EECS 995 the term of the Final Defense. The student must defend and complete all Rackham degree requirements before the final doctoral degree deadline for the term.

Timing/Grace Period

Rackham allows several additional weeks beyond the end of each semester for PhD students to complete all of the doctoral degree requirements. This additional time is known as the Grace Period. The Grace Period enables the student to complete their work without needing to register for the new semester. However, the degree is still awarded at the end of the new semester.

Please click for further details:

<http://www.rackham.umich.edu/current-students/policies/doctoral/phd-students/doctoral-degree-deadlines>

6. INFORMATION FOR NON-DEGREE (NCFD) STUDENTS

The ECE Division will occasionally admit qualified students who are not candidates for a degree (NCFD students) to enable them to take graduate courses. Such students typically have a full-time job in a local industry or business in Southeastern Michigan and take relatively few courses. NCFD status is only granted for one term at a time for up to two semesters.

A student who is interested in a graduate degree program is strongly encouraged to apply as a regular graduate student, and not as an NCFD student. However, students can transfer these credits once they are officially admitted into a graduate degree program.

7. ECE COURSE LIST

<https://ece.engin.umich.edu/academics/course-information/graduate-course-list/>

8. FORMS

Plan of Study:

<https://deptapps.engin.umich.edu/planstudy/student?dept=216002>

Petition Request:

<https://ece.engin.umich.edu/academics/graduate-programs/current-grad/petition-requests/>

Course Equivalency Request:

<https://ece.engin.umich.edu/wp-content/uploads/sites/4/2019/08/ECE-Equivalency-Request.pdf>

Thesis Proposal/Dissertation Committee:

<https://ece.engin.umich.edu/wp-content/uploads/sites/4/2019/09/ECE-Thesis-Proposal.pdf>

9. STUDENT HANDBOOKS AND INTERNET RESOURCES

The Rackham Graduate School Student Handbook and the Engineering College Bulletin are among the numerous UM publications available online. The Rackham Handbook gives details about the graduate degree requirements imposed by the Graduate School, and should be consulted by all graduate students. Some important topics include the continuous enrollment policy and fees. All EECS course descriptions are available on the web as well.

Rackham Graduate School: <http://www.rackham.umich.edu>

College of Engineering: <https://www.engin.umich.edu>

UM Wolverine Access: <https://wolverineaccess.umich.edu>

UM Registrar: <http://ro.umich.edu>

Student Financial Services: <http://www.finance.umich.edu/finops/student/>

UM International Center: internationalcenter.umich.edu

ECE Division: <https://ece.engin.umich.edu>

EECS Department: <https://eecs.engin.umich.edu>

CoE Honor Code: <https://bulletin.engin.umich.edu/rules/#subnav-1>

Student Rights and Responsibilities:

<https://oscr.umich.edu/article/statement-student-rights-and-responsibilities>

Consumer Information: <https://finaid.umich.edu/getting-started/consumer-information>