ECSE Graduate Program Handbook

2019

The Graduate Program Handbook contains the rules, policies, and guidelines applicable to the graduate community within the Electrical, Computer, and Systems Engineering Department at Rensselaer Polytechnic Institute.

Department of Electrical, Computer, & Systems Engineering

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Welcome

As Head of the Electrical, Computer, and Systems Engineering (ECSE), I would like to welcome you to the department to pursue your graduate education. This is an exciting time to be pursuing ECSE as a career – technology is advancing at breakneck pace, and you will be at the forefront of this tidal wave!

Ubiquitous sensors (e.g., from wearable devices) and autonomous devices (e.g., self-driving cars), all part of the Internet of Things (IoT), are producing data at an unprecedented and exponentially growing rate. New communication technology – think beyond 5G – and network architectures provide the infrastructure to move this massive amount of data efficiently and securely. Advanced algorithms interpret the data, make decisions, and choose actions based on data analytics, model prediction, and optimization, and drawing on artificial intelligence and machine learning (AI/ML). Combinations of new computer architectures, interconnect designs, and data processing are continuing the acceleration in computation, despite computer chips rapidly approaching the limit of Moore's Law. You will be part of the ECSE family contributing to the exciting advances at these frontiers. ECSE faculty conduct a broad range of research including advanced computer architecture, photonics, Terahertz sensors, power electronics, IoT, cyberphysical systems, power systems, robotics, AI/ML, augmented reality/virtual reality, human-robot interaction, and others.

ECSE faculty participate in a number of large research centers that support cross-disciplinary research, such as the NSF Engineering Research Center in Lighting Enabled Systems and Applications (LESA), the NSF/DoE Engineering Research Center for Ultra-Wide-Area Resilient Electrical Energy Transmission Networks (CURENT), the Center on Future Energy Systems (CFES), and the Center for Automated Technologies and Systems (CATS). These centers offer resources such as engineering staff and research equipment to help your research.

ECSE offers more than just technical studies – I would encourage you to use your graduate school experience to make life-long friends, learn about other fields, and engage the broader ECSE community through the ECSE Graduate Student Council.

Graduate study at a top engineering department may include moments of frustration, stagnation, or even confusion. ECSE faculty and staff are here to help, and Rensselaer offers many other resources. Don't hesitate to explore these avenues of support.

ECSE was founded over a century ago, and RPI is the oldest technical university in the United States. We have had numerous illustrious alumni, including inventors of the digital camera and microprocessors, National Freedom Medal winners, successful entrepreneurs, and university presidents. You will be part of this tradition!

I wish you the best with your graduate studies in ECSE -- and have fun in the process!

John T. Wen
Department Head

Introduction

Welcome to graduate study within the Electrical, Computer, and Systems Engineering (ECSE) Department at Rensselaer Polytechnic Institute! We are delighted that you have chosen to pursue graduate studies within our department.

The purpose of this handbook is to acquaint new and continuing ECSE graduate students with Departmental expectations and the requirements that a student must satisfy in order to complete a graduate degree. This manual contains specific Departmental requirements in addition to pertinent Institute rules and regulations. Additional information can be found on our website at http://ecse.rpi.edu/ the RPI Catalog.

For additional information or explanation of any of the requirements, please contact the ECSE Graduate Student Services Office by calling (518) 518-276-6225 or emailing gradinfo@ecse.rpi.edu.

Contact List

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Degree Programs

The ECSE Department offers a Master of Engineering (MEng), Master of Science (MS), and a Doctor of Philosophy (PhD) in Electrical Engineering (ELEC) and in Computer and Systems Engineering (CSYS). There is no difference in the requirements between the ELEC and CSYS majors. Students should simply choose the major that best matches their area of interest.

Master of Engineering in ECSE (MEng Degree)

The MEng is a terminal degree for those who wish to enter professional practice upon completion. Students entering the program typically hold an accredited bachelor's degree in an appropriate branch of engineering. A master's thesis or project is not required.

Students pursuing the MEng in ELEC or CSYS need to complete the following:

- 30 credits
- A Technical Concentration consisting of 3 courses in the same area. Having one as a pre-requisite for one of the others is preferable, but not required (and not possible in some areas).
- At least 18 credits at the 6000 level
- At least 15 credits within the ECSE Department*
- At least one Math elective
- Six (6) credits taken outside of the ECSE Department that are not technically related (e.g. courses in Economics or Management)
- No more than 6 transfer credits
- No more than 3 credits of Independent Study (e.g. ECSE-6940)

Students who do not have adequate preparation for their chosen area of specialization may need to take background courses in addition to the 30-credit-hour requirement. In particular, no 1000- or 2000- level courses may be applied to a graduate degree at RPI.

Although students may elect to pursue the PhD after completing the MEng, it is strongly recommended that any student considering the PhD choose the MS degree program (preferably with a thesis) in order to get a feel for doing research.

*Any exceptions will require prior written approval from the Graduate Program Director

Master of Engineering in ECSE - Program Planner

Name_____ **Entry Term**_____

Graduation Requirements: 30 credits

- **At least 18 credits must be taken at the 6000 level.**
- **At least 15 credits must be taken within the ECSE Department (ECSE XXXX).**
- **Nine (9) credit Technical Concentration**
- **Six (6) credits must be taken outside of the ECSE Department, not technically related to ECSE (e.g. Management, ECON, HASS).**
- **At least one Math elective (3-4 credits)**
- **No more than 6 transfer credits**
- **No more than 3 credits can be taken as an Independent Study (e.g. ECSE-6940)**

Course #	Course Title	Credits	Term/Year
I. Required – Technical Concentration (9 credits)			
ECSE - _____	_____	_____	_____/_____
ECSE - _____	_____	_____	_____/_____
ECSE - _____	_____	_____	_____/_____
II. Math Elective (3-4 credits)			
MATH- _____	_____	_____	_____/_____
III. Required - Non-Technically Related, Outside-ECSE Courses (6 cr.)			
_____- _____	_____	_____	_____/_____
_____- _____	_____	_____	_____/_____
IV. Free Electives (11-12 credits)			
_____- _____	_____	_____	_____/_____
_____- _____	_____	_____	_____/_____
_____- _____	_____	_____	_____/_____
_____- _____	_____	_____	_____/_____
Total Credits:		_____	

The Master of Science (MS) without Thesis Degree

The MS without thesis is also intended to be a terminal degree for those who wish to enter professional practice upon completion. Students entering the program typically hold an accredited bachelor's degree in an appropriate branch of engineering. A 6-credit master's project, with faculty supervision and evaluation, is an option.

Students pursuing the MS in ELEC or CSYS need to complete the following:

- 30 credits
- At least 18 credits taken at the 6000 level
- At least 18 credits taken within the ECSE Department*
- No more than 3 credits of Independent Study (ECSE-6940)
- No more than 6 transfer credits
- At least one Math elective

Students who do not have adequate preparation for their chosen area of specialization may need to take background courses in addition to the 30-credit-hour requirement.

*Any exceptions will require prior written approval from the Graduate Program Director

Master of Science without Thesis - Program Planner

Name_____ **Entry Term**_____

Graduation Requirements: 30 credits

- **At least 18 credits must be taken at the 6000 level.**
- **At least 18 credits must be taken within the ECSE Department (ECSE XXXX).**
- **At least one Math elective (3-4 credits)**
- **No more than 6 transfer credits**
- **No more than 3 credits can be taken as an Independent Study (e.g. ECSE-6940)**

Course #	Course Title	Credits	Term/Year
I. Required – ECSE Coursework (18 credits)			
ECSE - _____	_____	_____	_____/_____
ECSE - _____	_____	_____	_____/_____
ECSE - _____	_____	_____	_____/_____
ECSE - _____	_____	_____	_____/ _____
ECSE - _____	_____	_____	_____/ _____
ECSE - _____	_____	_____	_____/ _____
II. Math Elective (3-4 credits)			
MATH- _____	_____	_____	_____/_____
III. Free Electives (9 credits)			
_____- _____	_____	_____	_____/_____
_____- _____	_____	_____	_____/_____
_____- _____	_____	_____	_____/_____
Total Credits		_____	

The Master of Science (MS) with Thesis Degree

The MS program with thesis is designed to prepare students for research-oriented careers and/or eventual pursuit of a doctoral degree. Students entering the program typically hold an accredited bachelor's degree in an appropriate branch of engineering.

Students pursuing the MS in ELEC or CSYS must complete the following:

- 30 credits
- At least 15 non-thesis credits taken at the 6000 level
- At least 12 credits taken within the ECSE Department*
- At least one Math elective
- No more than 6 transfer credits
- No more than 3 credits of Independent Study (ECSE-6940)
- Six (6) OR nine (9) MS thesis credits. Six is typical. Nine is for cases requiring an exceptional amount of work and must be justified by the student's research advisor.

Students who do not have adequate preparation for their chosen area of specialization may need to take background courses in addition to the 30-credit-hour requirement.

*Any exceptions will require prior written approval from the Graduate Program Director

Master of Science with Thesis - Program Planner

Name_____ **Entry Term**_____

Graduation Requirements: 30 credits

- **At least 15 (non-thesis) credits taken at the 6000 level.**
- **At least 12 credits taken within the ECSE Department (ECSE XXXX).**
- **Six (6) *OR* Nine (9) MS thesis credits**
- **At least one Math course (3-4 credits)**
- **No more than 6 transfer credits**
- **No more than 3 credits of Independent Study (e.g. ECSE-6940)**

Course #	Course Title	Credits	Term/Year
I. Required – ECSE Coursework (12 credits)			
ECSE - _____	_____	_____	_____/_____
ECSE - _____	_____	_____	_____/_____
ECSE - _____	_____	_____	_____/_____
ECSE - _____	_____	_____	_____/_____
II. Math Course (3-4 credits)			
MATH- _____	_____	_____	_____/_____
III. Master's Thesis (6 *OR* 9 cr.)			
ECSE-6990	_____	_____	_____/_____
ECSE-6990	_____	_____	_____/_____
ECSE-6990	_____	_____	_____/_____
IV. Free Electives (5-9 credits)			
ECSE - _____	_____	_____	_____/_____
_____- _____	_____	_____	_____/_____
_____- _____	_____	_____	_____/_____
Total Credits		_____	

Forming an MS Committee

MS (thesis) students are expected to formulate a thesis problem in consultation with their research advisor. The supervision of the research for the thesis is entrusted to a committee, whose members are selected by the student and advisor and must then be approved by the Graduate Program Director (GPD) and the Office of Graduate Education (OGE). The committee consists of three members, with the advisor serving as chair. Typically, the committee includes three ECSE tenure-track faculty, but exceptions can be made when appropriate. If a student wishes to nominate someone from outside the department to serve on the committee, the advisor will need to submit a brief justification to the GPD, detailing how this external member is particularly knowledgeable in the student's research area.

Once the committee is determined, the student is expected to file a Nomination of Master's Thesis Committee form with the Graduate Program Secretary, who will forward the original document to the Graduate School for final approval. This document is due to the Graduate School at the beginning of the semester the student intends to graduate. Please refer to the Academic Calendar for the exact deadline that applies to your graduation semester.

Master's Thesis & Oral Presentation

All MS with thesis students are expected to present their research orally. This is typically done during the semester in which the student intends to graduate. The required oral presentation, which must be approved by the thesis advisor, can be one of the following:

1. Program or Institute Seminar
   NOTE: A presentation announcement must be posted publically within the department (electronic or paper copy) at least two weeks before the date of the presentation. Faculty representation is required. Contact the Graduate Program Secretary for electronic posting.

2. Presentation at a conference or symposium.

3. Traditional thesis defense.

The Record of Master's Thesis & Oral Presentation is completed and signed by the student's committee once the student has met the requirement for the oral presentation and the thesis meets the approval of the committee.

Thesis Submission

After meeting the oral presentation requirement, all MS candidates must submit the thesis to the Office of Graduate Education (OGE) for final approval. OGE has stringent formatting specifications and requirements for all submissions. It is imperative that you review the Thesis Writing Manual prior to the submission of your document. We highly encourage you to make an appointment with the Graduate School for a preliminary review of your thesis at gradschool@rpi.edu before your formal submission. The manual can be accessed directly from the Graduate School's website.

Please refer to the Institute's Submit Your Thesis page to access the Master's Thesis Checklist, the Submission Tips and Techniques online workshop, and the Submission site. Please note that your thesis will be subject to an academic integrity review. All figures and text that have been previously published must be referenced. This includes your own work previously published elsewhere! Please refer to the thesis manual for an example of how to cite previously published work.

Degree Clearance

To receive a degree at the end of any semester, the student must be registered that particular semester, have an up-to-date Plan of Study on file, successfully complete all of the credits listed on his or her Plan of Study (min. 3.0 GPA), submit a degree application, and receive approval of the thesis by the Graduate School. The thesis must be submitted to the Graduate School Office by the date specified in the Institute calendar.

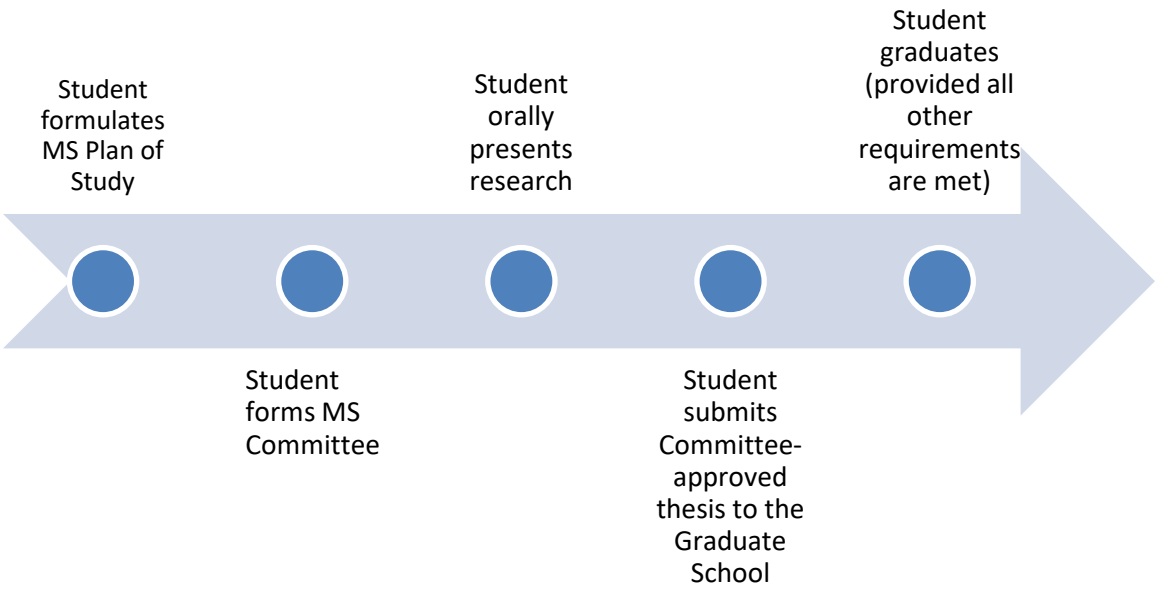

Figure 1. Steps in MS ECSE program

Co-Terminal Degree (BS/MEng or BS/MS Degree)

ECSE's Co-Terminal program is open to current ECSE undergraduates. The purpose is to provide top undergraduates an opportunity to pursue a Master's degree while maintaining their undergraduate Rensselaer funding. Co-Terminal students are required to graduate with their bachelor's degree in up to eight semesters, with a minimum GPA of 3.0. After graduating with a BS degree, they have up to two semesters to complete a master's degree. The GRE exam is not required. RPI students with a BS degree in a closely related field are encouraged to consult with the ECSE graduate services office or the GPD before applying.

Application Requirements

- Minimum 90 credits completed (typically second semester junior year)
- Minimum 3.5 GPA to be considered
- Submit the Co-Terminal Application with all sections completed
- Submit a 4th and 5th year course plan
- Submit a copy of your Degree Works report
- Submit two (2) letters of recommendation (at least one must be from faculty)
- Submit a resume
- Submit a well-written Statement of Background and Goals
- Submit a completed Master's Plan of Study

Deadline to apply: October 1st if your normal BS graduation is in the spring; April 1st if your normal BS graduation is in the fall.

Co-terminal students can pursue either the MEng or MS degree, but the MS non-thesis is recommended for most students. If you wish to apply for the MS with thesis program, you will need to identify a research advisor before your application will be considered. BS/MEng students will continue to be advised by their undergraduate advisor unless they are pursuing a MEng/MS with project. In this case, the student's research advisor serves as the academic advisor.

Co-Terminal FAQ's

1. **Can I receive both undergraduate financial aid and graduate TA/RA aid?**

   No. Co-terminal students cannot receive graduate financial aid. You should speak with the Graduate Program Administrator about applying for the traditional Master's program if you receive a verbal graduate financial aid offer and are uncertain about how to proceed.

2. **Do I have to file a FAFSA for my 5th year to get the undergraduate aid?**

   Yes. You must file a FAFSA if you receive need-based aid.

3. **When do I receive my B.S. degree?**

   You will receive BS and MEng/MS degrees once you have satisfied the requirements of each degree program. You should file a degree application with the Office of the Registrar for the BS degree at the beginning of the semester in which you will actually graduate. See the academic calendar for deadline information.

4. **Can I use a course for both my undergraduate and graduate degree?**

   No. The credits applied toward satisfying requirements of the undergraduate degree cannot be used to satisfy the requirements for the Master's degree.

5. **I finished my 8th semester but decided not to continue in the Co-Term program. How do I receive my BS degree?**

   You must formally withdraw from the co-terminal program via the Graduate Student Request for Change of Status form. You must then file a Degree Application for the next graduation date. Rensselaer has three official graduation dates - the end of August, the end of December, and the end of May.

6. **Can I still designate courses as Pass/No Credit?**

   Co-terminal students are subject to graduate degree program guidelines after they have earned the minimum number of credits required for their bachelor's degree. Any courses taken after a student has reached the minimum will be subject to graduate level policies, and graduate policies prohibit designating a graduate course as Pass/No Credit.

7. **Can I participate in the Commencement ceremony with my class?**

   You must meet the criteria for participation and file a petition, available in the Registrar's Office.

The Doctoral (PhD) Degree

The Doctor of Philosophy degree is awarded in Electrical Engineering or Computer and Systems Engineering. There is no difference in the requirements between these two. Students should choose the major that best matches their area of research. The most important distinction is that a doctoral degree requires a substantial, original contribution to knowledge in some area of ECSE.

Students entering the program should hold an accredited bachelor's degree in an appropriate branch of engineering. Prospective students interested in earning both the MS and PhD should apply directly to the PhD program, as they will have the opportunity to add the Master's degree once enrolled in the program. The doctoral degree requires a total of seventy-two (72) credits beyond a Bachelor's degree or forty-eight (48) credits beyond a Master's degree.

The PhD Requirements are:

- 72 credit hours beyond the Bachelor's degree; 48 credits beyond the Master's
- Two thirds of total credit hours (excluding thesis credits) at the 6000- level
- No more than fifteen 4000-level credits
- A minimum of 12 and a maximum of 36 dissertation credits
- One Math elective
- No more than 15 transfer credits
- No more than 3 credits of Independent Study

For students entering with a Master's degree, the Master's would be reflected in the 72-credit doctoral plan of study as a 24-credit block. This satisfies the residency requirement that 48 credits be completed at Rensselaer.

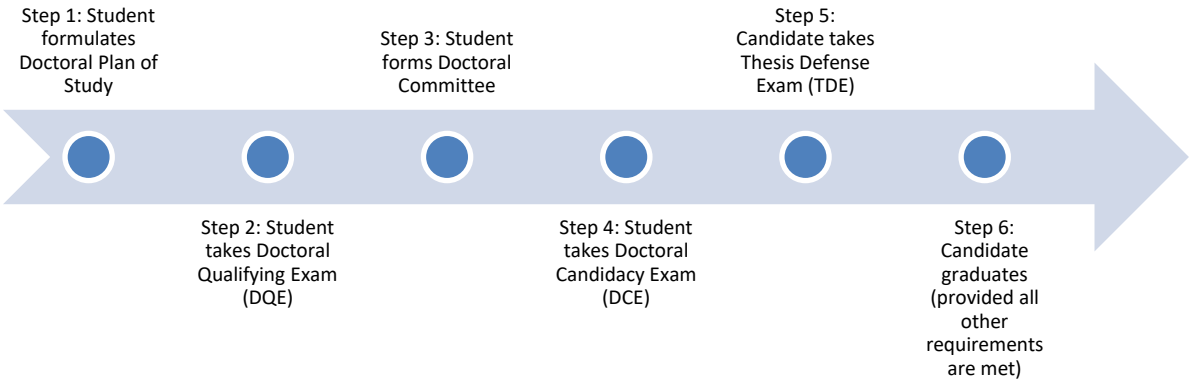

Figure 2. Steps in ECSE Doctoral program

Doctoral Qualifying Examination

The purpose of the DQE is to determine the potential or likelihood that the student will be able to satisfactorily complete the doctoral requirements, including the ability to produce high-quality independent research. The exam evaluates not only the student's knowledge, but also their ability to apply that knowledge to analyze and synthesize ideas at an advanced level in the areas being examined.

All students have two opportunities to pass the DQE. The DQE is given twice each academic year – usually during a two-week period in September and again in February.

It should be noted that, in the awarding of financial aid (including research and teaching assistantships), preference is given to those students who have passed the DQE. It is also important to make progress on research before taking the DQE.

The decision as to whether or not a student passes the DQE is made by the entire ECSE faculty after reviewing the student's performance on the four (4) oral exams, the student's academic record, and the recommendation of the student's research or project adviser(s) concerning the student's ability to conduct independent research of high quality.

The DQE consists of three parts:

1. **Four oral exams:** 1 Basic area exam, 2 Major area exams, and 1 Minor area exam. This is discussed in more detail below.
2. **Course grades:** Your grades in the courses you have taken at Rensselaer. This serves as the "written" part of the DQE.
3. **Research Advisor's Recommendation:** Your thesis advisor will evaluate your research to date. This part should not be underestimated, nor should the importance of getting started on research as soon as possible after starting your graduate program.

The Oral Exam Component of the DQE

The oral portion of the ECSE Doctoral Qualifying exam is individually structured for each student and consists of four (4) oral exams. Each oral exam is approximately one hour in length and conducted by an ECSE faculty member in one of the subject areas selected by the student. Specifically, one oral exam is given in the selected Basic Area, chosen from the "Basic Group": Physics, Mathematics, and Computer Science. Two oral exams are given in the selected Major Area, chosen from the "Elective Group": Circuits and Electronics, Control, Communications, Plasma and Electromagnetics, Microelectronics Technology and Design, Computer Systems, Computer Design, Image Analysis and Computer Vision, and Electric Power Engineering. One oral exam is given in the selected Minor Area, chosen from either the "Basic Group" or the "Elective Group" but not duplicating a Basic Area or Major Area selection.

The Oral portion of the DQE consists of four exams in areas that the student selects: one in the Basic Area, two in the Major Area, and one in the Minor Area.

Two important points should be noted regarding the DQE. First, students should not select an exam area unless they are familiar with the material in the three courses listed under that area (listed below), as well as the material contained in the prerequisite courses. Second, the three courses listed per subject area are provided only to guide the student in their DQE preparation; the courses serve only as a focus for examination, which might also touch upon other related material in the subject area. It should be noted that the oral examiner's primary objective is not to determine how much material a student knows in a given subject area, but how well the student is able to use and apply that knowledge.

Select exam areas with which you are familiar. You are expected to know the material in the courses listed within that area, as well as their pre-requisite courses.

DQE Subject Areas

Basic Group

1. Physics

PHYS-4100 Introductory Quantum Mechanics
PHYS-4210 Electromagnetic Theory
PHYS-4720 Solid-State Physics

2. Mathematics

MATH-4100 Linear Algebra
MATH-4300 Introduction to Complex Variables
MATH-4600 Advanced Calculus

3. Computer Science

CSCI-2300 Introduction to Algorithms
CSCI-4020 Design and Analysis of Algorithms
CSCI-4430 Programming Languages

Elective Group

4. Circuits and Electronics

ECSE-2010 Electric Circuits
ECSE-2050 Intro to Electronics
ECSE-4040 Digital Electronics

5. Control

ECSE-4440 Control Systems Engineering
ECSE-4510 Discrete-Time Systems
ECSE-2410 Signals and Systems

6. Communications

ECSE-4500 Probability for Engineering Applications
ECSE-4520 Communication Systems
ECSE-2410 Signals and Systems

7. Plasmas and Electromagnetics

ECSE-4320 Plasma Engineering
PHYS-4210 Electromagnetic Theory
PHYS-6590 Statistical Mechanics

8. Microelectronics Technology and Design

ECSE-2210 Microelectronics Technology
ECSE-4240 Solid State Electronics (or PHYS-4720 Solid State Physics)
ECSE-4250 Integrated Circuit Processes and Design

9. Computer Systems

CSCI-4210 Operating Systems
ECSE-2660 Computer Architecture, Networks, and Operating Systems
ECSE-4670 Computer Communication Networks

10. Computer Design

ECSE-2610 Computer Components and Operations
ECSE-4770 Computer Hardware Design
ECSE-4220 VLSI Design

11. Image Analysis and Computer Vision

ECSE-6610 Pattern Recognition
ECSE-4530 Digital Signal Processing
ECSE-4540 Introduction to Image Processing

12. Electric Power Engineering

ECSE-4110 Power Engineering Analysis
ECSE-4080 Semiconductor Power Electronics
ECSE-2100 Fields and Waves I

When is the DQE given?

The DQE is given twice each academic year – usually during a two-week period in September and again in February.

When should a student take the DQE?

ECSE graduate students should take the DQE before completing 15 credits beyond the master's degree. Full-time students admitted without a master's degree are expected to take the DQE in their third semester after entering the ECSE graduate program. Students who enter with a master's degree are expected to take the DQE in their second semester in the PhD program. In the awarding of financial aid (including research and teaching assistantships), preference is given to students who have passed the DQE. However, this should not encourage students to take the DQE before they are ready. It is also important to make progress on research before taking the DQE. Questions about how the DQE affects graduate financial aid should be directed to the Graduate Program Director, at gpd@ecse.rpi.edu .

How does a student apply to take the DQE?

Students planning to take the DQE, must complete the "Application for Doctoral Qualifying Examination" form (available in JEC 6009) and submit it to the Doctoral Program Secretary. They will receive a letter listing the four examiners and the exact timeframe of the two week examination period. It is each student's responsibility to coordinate the specific date and time of each exam with each examiner. If a student applies to take the DQE and fails to show up, the examination is counted as having been taken and the student has failed the exam.

How many times is a student allowed to take the DQE?

A student may take the DQE no more than twice**.**

What is the decision process for passing the DQE?

The decision as to whether a student passes the DQE is made by the entire ECSE faculty after reviewing **i)** the student's performance on the 4 oral exams; **ii)** the student's academic record; and **iii)** the recommendation of the student's research or project advisor(s) concerning their ability to conduct high-quality independent research. Since research is an important aspect of the doctoral program, the student is strongly encouraged to engage in research activities with a faculty advisor, either at the master's or doctoral level, before taking the DQE.

Forming a Doctoral Committee

As soon as the student has chosen a research area, they should arrange to conduct thesis research with a thesis adviser. If the thesis adviser is not a full-time tenure-track ECSE faculty member, then there must be a separate academic co-advisor who meets those criteria. If the student's thesis advisor is not a full-time Rensselaer faculty member, then a full-time ECSE faculty member must be Co-chair of the doctoral committee.

The student and the thesis adviser choose an appropriate doctoral committee. The student then completes a "Nomination of Doctoral Committee" form and submits it to the Doctoral Program Secretary at least one month prior to taking the DCE. The form can be accessed from the Graduate School's website at https://info.rpi.edu/graduate-academics/submit-your-thesis-dissertation/#Forms under the "Submit Your Thesis" tab, and a hardcopy can be found in JEC 6009. This form must be complete and contain the original signatures of the Committee members. The Office of Graduate Education (OGE) will not accept scanned or faxed versions of this form. After departmental approval, it is forwarded to the Graduate School, which then officially appoints the student's doctoral committee.

The committee should include at least four (4) members and represent the principal areas included in the student's Plan of Study. Three members must have an appointment within the ECSE Department (with the rank of assistant professor or higher) and one member must be from outside the ECSE Department. If a committee member is from outside Rensselaer, a curriculum vitae for this person must accompany the Nomination of Doctoral Committee form. In addition, the student's advisor (typically designated the committee chair) should provide a letter of support that specifies how the outside member will contribute to the student's research. The committee will conduct the student's Doctoral Candidacy Exam

(DCE) and the student's final Thesis Defense Examination. If any members of the doctoral committee change, the student will need to submit a new Nomination of Doctoral Committee form and a strong justification will be required.

Doctoral Candidacy Examination (DCE)

A student may apply for the candidacy examination when their course work nears completion and they have the approval of the doctoral committee. The request should be coordinated with the student's thesis adviser.

The DCE is an oral examination, conducted by the student's appointed doctoral committee, following submission of a written thesis proposal. The exact content and nature of the DCE is determined by the student's doctoral committee. Typically, it is a concise presentation of the work so far and the work proposed, followed by questions from the committee. The purpose of the DCE is to determine whether the student has made satisfactory progress in their doctoral program, including progress in the chosen doctoral dissertation area, and whether they demonstrate the ability and have a viable plan to complete the doctoral dissertation with distinction.

After the student's thesis proposal has been approved by the thesis adviser, copies of the proposal should be given to the doctoral committee, at least one (1) week prior to the scheduled DCE. The thesis proposal should include i) a concise discussion of the proposed thesis effort; ii) an in-depth review of the pertinent literature (together with how the proposed effort would build on and extend existing knowledge, either theoretically and/or practically); and iii) a concise presentation of some preliminary results which would suggest that the effort can be successfully undertaken. However, the scope of the DCE is not limited to the thesis proposal.

Record of Candidacy Examination

This form must be completed and brought to the DCE for the committee members' signatures and recommendations (pass or fail). The form can be found on the Graduate School's website at under the "Submit Your Thesis" tab and in JEC 6009.

Once the record of candidacy form is complete and has the original signatures of all committee members, it should be submitted to the Graduate Program Secretary for processing. The Graduate School will not accept scanned or faxed versions of this form. It should be noted that, after passing the DCE, the student is formally identified as a doctoral candidate.

Responsible Conduct of Research (RCR) training

The Graduate School requires the completion of Responsible Conduct of Research (RCR) training through CITI as well. A copy of the CITI Program completion report (certificate) must accompany the Record of Candidacy Examination form that is submitted to the Graduate School. Instructions for CITI registration and training can be found on the second page of the Record of Candidacy Examination Form.

Thesis Defense Examination (TDE)

The thesis defense is one of the final steps in the doctoral program. The purpose of the TDE is for the student to present and defend the doctoral thesis. The defense is conducted by the student's doctoral committee and is required to be open to the public. The ensuing committee deliberation is not open to the public, but there is a period where the candidate will field questions from the audience.

The TDE is given whenever i) the candidate has registered for all the credits shown on the Plan of Study, and ii) the candidate's doctoral committee approves the student's request for a TDE. The request should be coordinated with the student's thesis adviser. The TDE should be held by the date listed in the academic calendar for the semester of graduation. Furthermore, the completed thesis must be presented to the candidate's thesis adviser at least one month before the TDE. Each member of the doctoral committee must be given an unbound copy of the thesis at least two weeks before the scheduled TDE. An announcement – INCLUDING AN ABSTRACT – of the TDE must be prominently posted and an electronic copy sent to the Graduate Program Secretary at least one week prior to the TDE. It will then be distributed to all ECSE faculty members and current graduate students. If possible, a copy of your thesis should also be posted on your website with a link indicated on the announcement. (Students are encouraged to create a website of their own.)

An announcement of your defense (including an abstract) should be distributed to all ECSE Faculty and prominently posted, and an electronic copy must be forwarded to the Graduate Program Secretary.

After passing the TDE, the student will need to submit a completed Record of Dissertation Exam form to the Graduate Program Secretary. This form must be complete and contain the

original signatures of the Committee members. The dissertation must be approved by a minimum of three members of a faculty committee of four members. By signing this form, your Committee members are indicating that both your defense and dissertation have met their approval. The Office of Graduate Education (OGE) will not accept scanned or faxed versions of this form.

	OGE requires a complete, signed Record of Dissertation Exam Form and supporting documents by the published dissertation submission deadline that can be found in the Academic Calendar. For a list of the forms that need to be submitted to OGE after the TDE, please refer to the Doctoral dissertation checklist.

Thesis/Dissertation Submission

All doctoral candidates must submit a doctoral dissertation to the Office of Graduate Education (OGE) for final approval after passing the thesis defense. OGE has stringent formatting specifications and requirements for all submissions. It is, therefore, imperative that you review the Thesis Writing Manual before submitting your document. We highly encourage you to make an appointment for a preliminary review of your dissertation with OGE at gradschool@rpi.edu before your formal submission. The manual can be accessed directly from OGE's website.

Please refer to the Institute's Submit Your Thesis page to access the Dissertation Checklist, Submission Tips and Techniques, and the Submission site to upload one's dissertation, etc. Please note that your thesis will be subject to an academic integrity review. All figures and text that have been previously published must be referenced. This includes your own work previously published elsewhere! Please refer to the thesis manual for an example of how to cite previously published work.

Degree Clearance

To receive a degree at the end of any semester, the student must be registered that particular semester, have an up-to-date Plan of Study on file, successfully completed all credits listed on the Plan of Study (min. 3.0 GPA), submit a degree application, and receive approval of the thesis by the Graduate School. The thesis must be submitted to the Graduate School Office by the date specified in the Institute calendar.

General Departmental Requirements

Academic Integrity

As a member of an academic community, a high standard of academic conduct and integrity is expected of you. All graduate students must have a clear understanding of Rensselaer's Academic Integrity Policy and follow it at all times. Please access the Academic Integrity Brochure for more information. Your research should be accurate and the contributions of others must be clearly documented according to well-established practices. It is dishonest and unacceptable for you to represent another scholar's ideas or words as your own. Academic dishonestly is taken seriously by the Rensselaer community, and failure to comply with the academic code of conduct will result in disciplinary action, including the possible denial of your degree.

Academic Plan of Study

The graduate program is flexible and affords each student an opportunity to plan a course of study suited to his or her own objectives. To assure a coherent program in accord with the student's maturing capacities and goals, each student is to maintain, with the adviser's assistance, a Plan of Study (POS) for the degree for which he or she is studying. A POS is a form that lists the courses and thesis credits needed to satisfy the degree requirements. The Department requires all new students to file their first POS during their first semester.

A Plan of Study lists all of the courses and thesis credits needed to satisfy one's degree requirements. You cannot graduate or receive financial aid without an up-to-date Plan of Study on file. It is therefore important that you update your PoS whenever you deviate from the Plan currently on file.

The form can be accessed from the Graduate School's website here, under "Forms" and in JEC 6009. Once it is completed, it should be signed by the student and the academic adviser (who must be a full-time ECSE faculty member). It is then submitted to the ECSE Graduate Program Secretary in JEC 6009 for processing, including obtaining the signature of the ECSE Graduate Program Director.

Please note that the student must update the Plan of Study whenever changes occur to the previously submitted plan.

Masters of Engineering Plan of Study

A **Master's of Engineering Plan of Study** must list 30 credits beyond the Bachelor's degree. In satisfying the 30 credit hour requirement, the student's POS must list a minimum of 18 credits at the 6000- level, a minimum of 15 credits taken within the ECSE Department, six (6) non-technical credits, no more than 6 transfer credits, no more than 3 independent study credits, and at least one (1) math elective.

Master of Science Plan of Study

A **Master's of Science Plan of Study** must list 30 credits beyond the Bachelor's degree. In satisfying the 30 credit hour requirement for the **MS with Thesis** degree, the student's POS must list a minimum of 15 credits at the 6000 level, a minimum of 12 credits taken within the ECSE Department, six (6) or nine (9) thesis credits, and at least one math elective. For the **MS without Thesis** degree, the student's POS must list a minimum of 18 credits at the 6000 level, a minimum of 18 credits within the ECSE Department, at least one math elective, no more than 6 transfer credits, no more than 3 independent study credits, and nine (9) credits of electives.

Doctoral Plan of Study

A Doctoral **Plan of Study** must contain a minimum of 72 credit hours beyond the Bachelor's degree or 48 credit hours beyond a Master's degree. In satisfying the 72 credit hour requirement, the student's program cannot include any more courses from the 4000-4999 range than one-third of the total credit hours in all courses (excluding doctoral dissertation credits), with the further limitation that a maximum of 15 credits at the 4000 level is allowable. At least two-thirds of the total credit hours, excluding thesis, must be at the 6000-level. A maximum of 15 credits can be transferred, and no more than 3 credits may be taken as an Independent Study. As with all ECSE graduate programs, a math elective is required.

Registration Requirements

Rensselaer Polytechnic Institute requires fellowship holders and graduate assistants to register for a minimum number of credits each semester. The full-time load for a graduate student is 12 to 16 credit hours each term. The only exception to this requirement is for students serving as teaching assistants. TA's may register for a minimum of nine (9) credits to maintain their full-time status. The Department encourages *all* ECSE students to register

for a total of 16 credits per term. Each student should simply register for the courses approved by his or her advisor, and the remaining credits should be thesis or dissertation credits. This will ensure that you maintain a full academic load even if you need to drop a course at some point in the semester. Students who register for less than a full academic load jeopardize their student status, their visa status, and their financial aid. Please be very mindful of the add deadline (typically two weeks after the semester begins), as the Graduate School does not approve late add requests. You will not be allowed to add any courses beyond the add deadline, not even thesis credits. If you have enough credits to drop a course and stay at full-time status, the deadline is eight (8) weeks after the start of the semester.

Falling below a full academic load can jeopardize your visa, academic status, and financial aid. To avoid potential issues, the Department encourages you to register for 16 credits every semester that you are a full-time student. Simply register for the courses approved by your Advisor and all remaining credits should be thesis credits.

Summer Administrative Registration (SAR)

Summer Administrative Registration (SAR) is a no-charge registration requirement for graduate students who will be receiving a stipend over the summer or graduating in the summer semester. Students taking a credit-bearing course or research credits should not register for SAR.

Transfer Credit

Transfer credits must be approved by the ECSE Department, the Graduate School, and the Registrar's Office before they can be applied towards the degree. No more than six (6) credits may be transferred toward the master's degree as the residence requirement for the master's degree is 24 credit hours; no more than 15 credits may be transferred towards the 72-credit doctoral degree. Additionally, only courses completed with a grade of B or better can be transferred, and the credits must meet the requirements for the degree as outlined in this handbook. To initiate the transfer credit approval process, you must take the following steps:

1. Complete the transfer credit approval form.
2. Obtain a syllabus of the course you wish to transfer AND a syllabus for the Rensselaer equivalent course, and have these evaluated by the corresponding Rensselaer department. For example, if you want to transfer a Math course, you will

need the approval of the Rensselaer Math Department. If you want to transfer an ECSE course, the course syllabus should be evaluated by an ECSE faculty member.

3. Once departmental approval is obtained and the Rensselaer equivalent is determined, obtain your advisor's approval for the transfer of the course.
4. Update your Plan of Study so that it includes the transfer courses. Both student and advisor must sign the POS.
5. Submit the syllabi, the POS, and the transfer credit form to the department secretary to be reviewed by the Graduate Program Director.
6. The signed transfer credit approval forms will be forwarded to the Graduate School for the Dean's consideration.

Advising

New students have up to **six (6) weeks** after the academic semester begins to identify an advisor. In the interim, students will have the opportunity to meet with a faculty member from their area of specialization during a temporary advising session that takes place the same day as Orientation. Once an advisor is identified, you will be asked to submit an Advisor Form to the Graduate Program Secretary. It should be completed and signed by both you and your advisor. We encourage you to meet with multiple faculty members to determine the best match. Please access the Faculty Profiles on our website.

Doctoral Student Yearly Review Form (DSYR)

The Graduate School specifies that PhD students meet with their advisor each spring semester to review academic progress, update the plan of study on file, and complete and file a Doctoral Student Yearly Review (DSYR) form. The form is to be completed by the student and advisor, noting expectations, academic progress, and dates when milestones will be met.

Departmental Seminars (Mercer Lab Series)

All graduate students are required to attend bi-weekly departmental seminars as part of their education. Seminars typically fall on Wednesdays from 4-5 pm. Students are excused from seminars if they (1) have a regularly scheduled class that meets during the seminar timeslot or if (2) their TA assignment conflicts with the seminar timeslot.

Financial Aid

Financial aid is available in the form of Teaching Assistantships (TA), Research Assistantships (RA), and Fellowships. The continuation of your award is contingent upon your academic performance and your teaching work, if you have a TA assignment. ECSE graduate students are expected to maintain a grade point average of 3.0 or better.

Teaching Assistantships

A Teaching Assistantship provides a stipend and full tuition. For incoming students, the Graduate Teaching Assistantship is the most common form of aid. The Department deems this role a very important one, both for the contribution to departmental teaching needs and also because it enhances a graduate student's ability to provide mentorship, an invaluable preparation for any career.

Research Assistantships

A Research Assistantship provides a stipend and full tuition. The availability of Research Assistantships depends upon the research needs of individual professors' research programs. It is governed by contract requirements. Research assistantships are normally extended for the academic year, and in many cases, summer support is often also available.

Both types of assistantship are provided with the expectation that students will approach their duties with responsibility and professionalism befitting the reputation of RPI.

Fellowships

Students are encouraged to seek external fellowship funding as there are a multitude of fellowships that offer a higher stipend, networking opportunities, job training opportunities, prestige, etc. Please feel free to access the Graduate School's fellowship page on External Fellowships

Summer Support

Most students are supported via research assistantships during the summer. In 2019, the minimum summer stipend was $7,667.

Residency Requirement

A student working towards a master's degree must complete a minimum of 24 credit hours at Rensselaer. A student working towards a doctoral degree is required to take at least 48 credits of course and/or dissertation work beyond the BS degree at Rensselaer.

Time Limit for students pursuing a Master's degree

For full-time students pursuing a master's degree, all work must be completed within two and one-half years. Full-time students not fulfilling the master's requirements by the end of two and one-half years will be dismissed unless the Graduate School has given advance approval for additional time to complete the degree. Extensions are rare and are granted only for the most compelling reasons.

Part-time students must complete all work for the master's degree within three calendar years of the original admission date. Extensions may only be granted if the student is in good academic standing and has an acceptable Plan of Study. Working professionals must petition and receive approval from the Dean of Graduate Education.

Time Limit for students pursuing a Doctoral degree

For students entering without a master's degree, all work for the doctorate must be completed within seven years. Students entering with a master's degree in their field of study must finish all degree requirements for the PhD within a five-year time period. Students who have not met their applicable time limit will be dismissed from the program unless the Graduate School has given advance approval for additional time to complete the degree. Extensions are extremely rare and are only granted for the most compelling reasons. Students should contact the Graduate Program Administrator if there is any concern about meeting the deadline.

Individuals who leave Rensselaer without obtaining an authorized leave of absence, and who have not requested an extension before the time limit, will be dismissed from the program.

Housing

Graduate students arrange housing on their own, but you should know that there is an off-campus housing development exclusively for Rensselaer graduate students and graduate-level affiliates (post-doctoral fellows and visiting scholars). The Rensselaer Graduate Community at City Station was developed to make locating and entering housing at Rensselaer a hassle-free process and is within walking distance of the campus. Students who

choose City Station enjoy Rensselaer services such as the Rensselaer Shuttle and Rensselaer Public Safety, even though they reside off-campus in a private community. City Station West and City Station East offer two, three, and four bedrooms, and furnished suites for single students, whereas City Station South houses married couples and families. City Station South suites are unfurnished. At each location, utilities and internet are included in the rent, and each suite includes air conditioning, dishwasher, washer and dryer, and 24-hour video monitoring. All residents are provided off-street parking at no cost and access to an on-site exercise facility. Various retail outlets, including a coffee shop, sandwich shop, full service restaurant, and a hair salon are located on the first floors of West and East. For additional information, you may contact the Office of Student Living and Learning.

Graduate Center

The Graduate Center is housed within the Office of Graduate Education and was created as a service to graduate students, including co-terminal students, who would prefer to discuss an academic or personal issue on a confidential basis. This sort of consultation is characteristic of an Ombuds' office and is designed to confidentially, impartially, and informally assist students in resolving issues that may arise over an interpersonal dispute or other personal situation affecting their educational progress. The center also helps eligible students identify other campus offices and professionals who may be better equipped to assist them. Please go to https://info.rpi.edu/graduate-education/graduate-ombudsperson for additional information or contact Ms. Jenni Mullet at 518-276-8433.

General Links:

ECSE website: http://www.ecse.rpi.edu/
Advising & Learning Assistance Center: https://info.rpi.edu/advising-learning-assistance/
Career and Professional Development Center: http://www.rpi.edu/dept/cdc/
Co-Op / Internships: http://www.rpi.edu/dept/cdc/students/experience/coop/index.html
Course Catalog: http://www.rpi.edu/academics/catalog/
Registrar Forms: http://srfs.rpi.edu/update.do?catcenterkey=29
Student Information System: http://sis.rpi.edu/
Office of Graduate Education: http://gradoffice.rpi.edu/setup.do
Graduate Forms: http://gradoffice.rpi.edu/update.do?catcenterkey=20