The purpose of this manual is to anticipate and answer a number of questions which you might have about the Electrical, Computer, and Systems Engineering Doctoral Program. As indicated in Figure 1, there are six steps in the ECSE Doctoral Program. Additional information can be found in the RPI Catalog, which is available online. As this brochure presents the policies and procedures of the ECSE doctoral program, it is expected that each student will carefully review and follow it. Some of the most important information (such as time limits) is included near the end of this document. Additionally, there is an open meeting at the beginning of the Spring and Fall semesters at which the ECSE Doctoral Program is discussed.

- Who can I contact if I still have questions after carefully reading this brochure?

Your first point of contact for all forms and questions regarding ECSE Graduate Programs is the ECSE Graduate Program Secretary, Ms. Priscilla Magilligan (JEC-6012, X6225, pris@ecse.rpi.edu). She will either address your question directly or forward it as appropriate to the ECSE Graduate Program Administrator, Ms. Ronnie Rowe (JEC-6010, X2554, rower@rpi.edu) or the ECSE Graduate Program Director, Professor Kenneth S. Vastola (JEC-6003, X6074, vastola@ecse.rpi.edu).

- What types of Doctoral degrees are awarded?

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. The student should choose the major that best matches his or her area of research.

- What distinguishes a Doctoral degree from other degrees?

The most important distinction is that a Doctoral degree requires a substantial, original contribution to knowledge in ECSE. The series of six steps described in detail below is designed to first determine if the student is up to this task, then if he or she is making good progress on this goal, and finally to determine if he or she has achieved this goal.
Note: The student must undertake other activities (as described in this brochure), including selecting a doctoral research adviser, passing the indicated examinations, and submitting his/her dissertation to the Office of Graduate Education (OGE).
1. **DOCTORAL PLAN OF STUDY**

- **What is a Doctoral Plan of Study?**

In consultation with his/her academic adviser, a doctoral student must submit a Plan of Study (PoS) form which lists the courses and dissertation credits needed to satisfy the degree requirements. The form can be accessed from the Graduate School’s website at http://gradoffice.rpi.edu under “Forms” and in JEC 6012. In fact, during the entire period that the student is enrolled as a graduate student at Rensselaer, the student must update his/her Plan of Study whenever changes occur to the previously submitted plan. The Plan of Study is signed by the student and by the student’s academic adviser (who must be a full-time ECSE faculty member). It is then submitted to the ECSE Graduate Program Secretary in JEC 6012 for processing including obtaining the signature of the ECSE Graduate Program Director.

A Doctoral Plan of Study must contain a minimum of **90 credit hours** beyond the Bachelor’s degree or 60 credit hours beyond a Master’s degree. In satisfying the 90 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 twenty-one 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 typical plan of study has 45-54 credit hours of courses, including a reasonable "core sequence" of courses in a focused area of research, and 36-45 credit hours of dissertation credits.

In satisfying the 60 credit hours beyond the Master’s degree, a typical plan of study has 15-24 credit hours of courses (with a **maximum of six credits at the 4000 level**), including a reasonable "core sequence" in a focused area of research, and 36-45 credit hours of dissertation.

A Plan of Study lists all of the courses and dissertation 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.
2. DOCTORAL QUALIFYING EXAMINATION

● What is the purpose of the DQE?

The purpose of the DQE is to determine the student’s potential to successfully complete the doctoral requirements. Thus, the exam evaluates not only the student’s knowledge, but also his or her ability to apply that knowledge to analyze and synthesize ideas at an advanced level in the areas being examined.

The DQE consists of three parts:

1. 4 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.

● What constitutes 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 (i.e., an area selected from the "Basic Group": Physics, Mathematics, and Computer Science). Two oral exams are given in the selected Major Area (i.e., an area selected 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, Electric Power Engineering). One oral exam is given in the selected Minor Area (i.e., an area selected from either the "Basic Group" or the "Elective Group" but not duplicating a Basic Area or Major Area selection). Please refer to the “DQE Subject Areas” section below.

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, the student should not select an exam area unless he/she is familiar with the material in the three courses listed under that area, 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 his/her 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.

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Select exam areas that you are familiar with. You are expected to know the material in the courses listed within that area as well as their prerequisite courses.

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**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 Data Structures and Algorithms  
CSCI-4050 Computability, Compilers, and Complexity  
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 Fundamentals
ECSE-4080 Semiconductor Power Electronics
ECSE-2100 Fields and Waves I

**Oral Exam Selection**

*Basic* exam - select one from the Basic Group  
*Major* exams - select one area from the Elective Group  
*Minor* exam - select one from the Basic or Elective Group without duplicating the basic or major exam.

- **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 *prior* to completing 15 credits beyond the Master’s degree. Specifically, 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. Full-time Doctoral students who already hold a Master’s degree are expected to take the DQE in their second semester after entering the ECSE graduate program. 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. 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 impacts graduate financial aid should be directed to Ms. Ronnie Rowe, Sr. Student Services Administrator, at rower@rpi.edu.

Students who enter with a Master’s degree are expected to take the DQE their second semester within the program. Students’ admitted without a Master’s degree are expected to take the DQE their third semester within the PhD program.

● How does a student apply to take the DQE?

Students planning to take the DQE, must complete the "Application for Doctoral Qualifying Examination" form and submit it to the Doctoral Program Secretary in JEC 6012. Students will be notified when the application is available and due for submission prior to the commencement of the applicable semester. The student will receive a letter listing their four examiners and the exact timeframe of the two week examination period. It is the student’s responsibility to coordinate the specific date and times 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.

It is the student’s responsibility to arrange the examination schedule with the examiners.

A student is allowed to take the DQE at most twice.

● What is the decision process for passing the DQE?

The decision as to whether or not a student passes the DQE is made by the entire ECSE faculty after reviewing i) the student’s performance on the four (4) oral exams, ii) the student’s academic record, and iii) the recommendation of the student’s research or project adviser(s) concerning the student’s ability to conduct independent research of high quality. (Since research is an important aspect of the doctoral program, the student is strongly encouraged to engage in research activities with a faculty adviser, either at the master’s or doctoral level, prior to taking the DQE.)
3. **FORMING A DOCTORAL COMMITTEE**

As soon as the student has chosen a research area, the student should arrange to conduct the thesis work with a **thesis adviser**. If the thesis adviser is not a full-time ECSE faculty member, then there must be a separate academic advisor from ECSE. 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 with him/her.

The thesis adviser then recommends to the Graduate Program Director the nomination of a doctoral committee. Subsequently, the student 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 [http://gradoffice.rpi.edu/setup.do](http://gradoffice.rpi.edu/setup.do) under the “Submit Your Thesis” tab and can be found in JEC 6012. 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 fax versions of this form. After departmental approval, it is forwarded to the Graduate School which officially appoints the student’s doctoral committee.

The committee should include at least four (4) members; one of whom is designated the **Committee Chair or Co-Chair** (usually, the student's thesis adviser); and three of whom, must have an appointment within the ECSE Department, with the rank of assistant professor or higher. The fourth member of the committee 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 should provide a letter of support that includes how the outside member will contribute to the student’s research. The committee members should represent the principal areas included in the student’s Plan of Study. 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.

4. **DOCTORAL CANDIDACY EXAMINATION**

- **What is the purpose of the Doctoral Candidacy Examination (DCE)?**

  The purpose of the DCE is to determine whether the student has made satisfactory progress in his/her doctoral program, including progress in the chosen doctoral dissertation area, and whether he/she demonstrates the ability to complete the doctoral dissertation with distinction.

- **What constitutes the DCE?**

  The DCE is usually an oral examination following submission of a written Thesis Proposal. The oral examination is conducted by the student's appointed **doctoral committee**. 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 student should prepare a **Thesis Proposal** which has been approved by the thesis adviser. Copies of the proposal should be given to the student's 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**.

**● When should a student take the DCE?**

A student may apply for the candidacy examination, given by the doctoral committee, when his/her course work nears completion and he/she has the approval of the doctoral committee. The request should be coordinated with the student’s thesis adviser.

**● How many times is a student allowed to take the DCE?**

Normally, a student is allowed to take the DCE at most twice. However, the student's doctoral committee, in consultation with the Graduate Program Director and the Graduate School, decides this issue.

**● What is the decision process for passing the DCE?**

The student's doctoral committee decides whether or not the student passes the DCE.

**● What form should be completed after passing the DCE?**

The student's **doctoral committee should complete** a "**Record of Candidacy Examination**" form and **submit it to the Doctoral Program Secretary**. This form can be found on the Graduate School’s website at [http://gradoffice.rpi.edu/setup.do](http://gradoffice.rpi.edu/setup.do) under the “Submit Your Thesis” tab and in JEC 6012. 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 fax versions of this form. Furthermore, it should be noted that after passing the DCE, the student is formally identified as a **doctoral candidate**.

**● Are there any other PhD Candidacy Requirements?**

The Graduate School now 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
5. THESIS DEFENSE EXAMINATION

● What is the purpose of the Thesis Defense Examination (TDE)?

The purpose of the TDE is for the candidate to present and defend his/her doctoral dissertation. (It is assumed that the student has kept in close communication with his/her thesis adviser throughout his/her doctoral research.)

● What constitutes the TDE?

The TDE is conducted by the student's doctoral committee. The thesis presentation must be open to the public, while the ensuing committee deliberation is not. There must be a period for questions of the candidate from all audience members.

● How many times is a candidate allowed to take the TDE?

The candidate's doctoral committee, in consultation with the Graduate Program Director and the Graduate School, determines if and when a candidate may retake the TDE.

● Is your doctoral committee still valid?

The Graduate School will check to see that your doctoral committee meets all Institute requirements at the time of your dissertation submission to their Office. The members listed on your Record of Dissertation Exam Form should be the same members that were approved by the Graduate Program Director and OGE. If changes to your Committee occur, a formal request to OGE will need to be made before your defense occurs. See the Doctoral Program Secretary to address this as soon as the potential for a change in committee membership becomes a possibility.

Failure to report changes (if any occur) to your Committee may cause graduation and/or dissertation review delays.

● When should a candidate take the TDE?

The TDE is given whenever i) the candidate has already 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. Furthermore, i) the completed thesis must be presented to the candidate's thesis adviser at least one month before the TDE. ii) 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 Doctoral Program Secretary at least one week prior to the TDE for distribution to all the ECSE faculty members and current graduate students. If possible, a copy of your thesis should also be posted on your website (students are encouraged to create one) with a link indicated on the announcement.

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 Doctoral Program Secretary.

● What is the decision process for passing the TDE?

The candidate's doctoral committee decides whether the candidate passes the TDE.

● What forms should be completed after passing the TDE?

After passing the TDE, the student will need to submit a completed Record of Dissertation Examination form to the Doctoral Program Secretary. This form must be complete and contain the original signatures of all of the Committee 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 fax 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.

6. OTHER DOCTORAL PROGRAM REQUIREMENTS (ALSO, REFER TO RPI CATALOG)

● Thesis Submission

All doctoral candidates are required to 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 prior to the submission of your document. We highly encourage you to make an appointment for a preliminary review of your dissertation with OGE before your formal submission. The manual can be accessed directly from OGE’s website.

The site is:


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.

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**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 at http://www.rpi.edu/dept/grad/docs/AcademicIntegrity.pdf for more information.

As a researcher, 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 dishonesty 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.

Please note that your dissertation 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.

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**Diploma and Graduation**
After passing the TDE, the candidate graduates at the next official graduation date (i.e., in May, August, or December), provided all doctoral program requirements are satisfied.

Students should obtain a degree application form from the Registrar’s Office at the beginning of the term in which they plan to graduate. The completed form is returned to the Registrar’s Office. (Refer to the Academic Calendar in the Catalog for the exact deadline date.)

Students who plan to graduate in a specific term must be registered for course credits or thesis credits during the term in which they intend to graduate.

A copy of the approved thesis should be distributed to the Graduate School, the student’s thesis adviser and the Doctoral Committee (if requested).

● "Resident" Restriction

A student working towards a doctoral degree is required to take at least 48 credits of course and/or dissertation work beyond the Bachelor’s degree from Rensselaer.

● Time Limit

For students entering without a Master’s, all work for the doctorate must be completed within seven years of registration for the first credits applied toward the 90 credits required for the Ph.D. Students entering with a master’s degree in their field of study must finish all degree requirements for the PhD within a continuous five-year time period. Students who have not met their applicable time limit will be dismissed from the program unless the Office of Graduate Education has given advanced approval for additional time to complete the degree. Extensions are granted for only the most compelling reasons and are extremely rare. Students should contact the ECSE Program Secretary as soon as possible, if it begins to appear that they may not meet these time limits.

● Financial

Any outstanding fees must be paid.
APPENDIX

The following is a checklist of forms which are required as part the successful completion of an ECSE doctoral program.

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