Electrical & Computer Engineering

Graduate Student Handbook

2019-2020

P.C. Rossin College of Engineering and Applied Science

LEHIGH UNIVERSITY

Welcome from the Department Chair

To our Graduate Students:

On behalf of the ECE Department faculty and staff, I wish to welcome you to Lehigh University. We trust that you will have a successful and rewarding experience in the Department of Electrical and Computer Engineering. During your stay at Lehigh, we encourage you to get to know all ECE faculty and your fellow students, to develop both breadth and depth in your professional training.

The 2019-2020 Department Handbook was prepared to assist you during your graduate experience at Lehigh. The ECE Department Handbook supplements but does not supersede the College of Engineering and Applied Science Graduate Student Handbook. I encourage you to refer to both the University Catalog and the Graduate Student Handbook for further information.

Welcome to Lehigh University!

Dr. Chengshan Xiao
Department Chair

Electrical & Computer Engineering
Department Personnel

Prof. Chengshan Xiao, Department Chair	chx417	610-758-4070
Prof. Doug Frey, Assoc. Chair	drf3	610-758-4065
Prof. Zhiyuan, Yan Faculty Graduate Coordinator	zhy6	610-758-3415
Prof. Zhiyuan Yan, Director – Computer Eng	zhy6	610-758-3415
Ms. Ruby Scott, Administrative Specialist	rls304	610-758-4070
Ms. Jessica Berton, Administrative Coordinator	jeb717	610-758-4068
Mr. David Morrisette, Systems Administrator	dpm3	610-758-3218

P.C. Rossin College of Engineering & Applied Sciences
Graduate Personnel

Prof. Steve DeWeerth, Dean	spd416	610-758-5308
Prof. John Coulter, Senior Assoc. Dean for Research	jc0i	610-758-6310
Ms. Brianne Lisk, Manager, Graduate Programs	brc3	610-758-6310

Academic Year Calendar

Event	Fall 2019 Semester
First day of Class	Monday, August 26
Last day for Web Registration	Sunday, September 1
Summer degree award date	Sunday, August 25
Labor Day-classes held	Monday, September 2
Last day to drop/add without a "W"	Friday, September 6
Deadline to apply for January Degree	Tuesday, October 1
Pacing Break	Monday-Tuesday, October 14-15
Registration for Spring 2020	Monday-Friday, November 11-15
Last day for January Doctoral candidates to deliver dissertation drafts to Dean	Tuesday, November 12
Last day to drop class with a "W"	Tuesday, November 12
Thanksgiving Break	Wednesday-Friday, November 27-29
Last day of Classes	Friday, December 6
Last day for January MS candidates to electronically upload their Thesis and deliver final paperwork to the Registrar's Office	Friday, December 6
Last day for January Doctoral Candidates to complete all degree requirements	Friday, December 6
Final Exams Begin	Tuesday, December 10
Final Exams End	Wednesday, December 18
Last date to register for Spring courses to avoid the $100 late fee	Wednesday, January 1

Academic Year Calendar (Cont.)

Admissions

Event	Spring 2020
January Degree Award Date	Sunday, January 19
First day of Class	Monday, January 20
Last day for Web Registration	Sunday, January 26
Last day to drop/add without a "W"	Friday, January 31
Last day to apply for University Day Degree	Saturday, February 1
Spring Break	Monday-Friday, March 9-13
Registration for Summer and Fall	Monday-Friday, April 13-April 17
Last day for May Doctoral Candidates to deliver dissertation draft to Dean	Friday, April 10
Last day to drop class with a "W"	Friday, April 10
Last day of class	Friday, May 1
Last day for May Doctoral Candidates to complete all degree requirements	Friday, May 1
Last day for May MS candidates to electronically upload their thesis and deliver final paperwork to the Registrar's office	Friday, May 1
Final Exams Begin	Tuesday, May 5
Final Exams End	Wednesday, May 13
University Day Commencement	Monday, May 18
Deadline to apply for September Degree	Monday, July 1
Last day to register for Fall courses to avoid the $100 late fee	Monday, July 1
Last day for September MS candidates to electronically upload thesis & deliver final paperwork to the Registrar	Friday, August 7
Last day for all September Doctoral Candidates to complete all degree requirements	Friday, August 7

Deadlines:
Fall applications - January 15th for financial aid (PhD only). April 1st for admission only
Spring applications - November 1st for everyone

Financial Aid:
The department offers three types of financial aid: research assistantships, teaching assistantships, and fellowships. These are exclusively for PhD applicants, except in very rare exceptions as determined by the ECE Department. All generally include a monthly stipend and tuition.

General Information:
Offers of admission may be deferred for up to one full academic year.
Tuition rates for the 2019-2020 academic year are $1,500/credit. All full-time students and International students are required to take 9 credits each semester to maintain full-time status (for exceptions, please see the College Handbook). International students who are admitted without financial aid will be required to submit an affidavit of support in the amount of roughly $42,634 which includes tuition, living expenses, insurance, and other fees for one year before any visa documents will be issued.

Applications: All applications must be submitted online. If you have questions concerning the program or application process, please contact the department at inecegr@lehigh.edu. The correct mailing address for transcripts is as follows:

Lehigh University
ECE Graduate Coordinator
19 Memorial Drive West
Bethlehem, PA 18015

Incomplete or late applications **will not** be processed or reviewed. This includes applications without the $75 application fee which **CANNOT** be waived for any reason. Once the application is submitted you will receive an e-mail confirming its receipt. Please allow time for mailing delays and processing before receipt of e-mail. All communication will be done via e-mail, so please provide one current e-mail address. Decisions for Fall semester will be announced starting in March. Decisions for the Spring semester will be announced starting mid-November.

All the Admissions information and application can be found on our website:

https://engineering.lehigh.edu/ece/ece-graduate-studies/ece-graduate-admissions

Degrees Offered:

MS, MEng, PhD in Electrical Engineering
MS, MEng, PhD in Computer Engineering
MS in Photonics

Minimum Requirements:

BS in EE, CompE, CS or related field

GPA
- 3.0/4.0 required for PhD applicants
- 2.75/4.0 required for MS/MENG applicants

Minimum Test Requirements

GRE General Test
- 75th percentile or better on Quantitative

iBT TOEFL
- 79 composite score
- 20 Writing, 20 Speaking, 20 Reading, 15 Listening

IELTS
- 6.5 minimum score
- 6.0 Writing, 6.5 Speaking, 6.5 Reading, 6.0 Listening

Application Fee: US $75 which cannot be waived for any reason.
Data Sheet: asks for personal data, proposed program information, test data, educational background, and work experience.
Transcripts: upload to online application. If accepted, an official transcript is required from all undergraduate and graduate programs attended. All transcripts must be received in sealed envelopes.
Letters of Recommendation: 2 letters of recommendation are required. If you are currently in school, letters from academic advisors and other professors are preferred. If you are currently in industry, letters from employers are acceptable. All letters should be uploaded to the application. We provide two recommendation forms in the PDF application that you may choose to use, however, letters on recommenders' letterhead is also acceptable.

Test scores: official test scores must be sent from ETS. Scores must be current and valid. TOEFL and IELTS scores expire after 2 years and expired scores **WILL NOT** be accepted. GRE test scores expire after 5 years. TOEFL and IELTS test scores will be waived ONLY if an International Applicant has completed a degree program at a U.S. university.

Essay/Statement of Purpose: a brief statement of career and research objectives. Essays should articulate clearly your experience and goals. Half a page to two pages is sufficient..
Supplemental Information: applicants should also include a resume or CV, current research or creative work, list of published works, and extracurricular activities.
Application for financial aid: **MUST** be completed in order to be considered for any kind of aid. (for PhD applicants)

Procedures for New Graduate Students

Check In and Starting dates
Students are expected to be on campus at least one week prior to the start of classes in time for new student orientations, testing, and registration. International students must report to the Office of International Students & Scholars, located in Coxe Hall, immediately upon arrival on campus.

Required Orientations
Plan on attending all the orientations from the Graduate Life office for incoming students.
https://gradlife.web.lehigh.edu/orientation/welcome
For international students, there will also be an orientation
https://global.lehigh.edu/oiss/gettinghere/orientation
The department office will also hold an orientation in the week before classes begin.

English Speaking
Spoken English is the expected language in all labs.

Seminars

ALL full time graduate students in the department are **required** to attend department seminars. Seminar announcements are sent to your Lehigh e-mail accounts. Seminars are generally scheduled at 4:10 p.m. Full time students must attend at least 75% of all the seminars offered in a semester. **Attendance will be taken**.

Academic Requirements

Full-Time Certification
All International graduate students must maintain full-time status while attending Lehigh. Full-time students must be registered for 9 credits (3 Courses) each semester or satisfy the requirements to be certified full-time. All PhD students that are in Candidacy and taking one credit, need to be certified Full Time. If you need to be certified full-time you may pick up the appropriate form in the Department office and speak with the Graduate Coordinator to make sure you satisfy all requirements. Domestic students who must maintain full-time status for insurance purposes, etc. must also be registered for 9 credits per semester or certified full-time.

All RAs and TAs must be full-time students as stated in your offer letter. Failure to do so will make you ineligible for any assistantships.

Registration
All current students are asked to register for their semester courses at a specified date during the previous semester. Failure to do so will result in a late fee of $100 assessed by the Registrar. (January 2 for spring classes and July 1 for fall classes) New graduate students register the week before classes begin.

All students will have the first week of classes to add and drop online if they wish. Students also have the second week of classes to add and drop but must fill out a paper form and acquire signatures for approval.

Advisors
All students are required to consult with their advisor before they register for courses each semester. The advisor will review the courses and supply the student with their Registration PIN#. New Registration PIN numbers are assigned each semester.

New Masters graduate students will be assigned an advisor when they arrive on campus. If a Masters student decides to submit a thesis as part of their program, they will need to identify a faculty member who is willing to supervise their research, and that faculty member will become their academic advisor as well. Please be advised that our faculty have many commitments, and the availability of faculty for research supervision is not guaranteed and depends on the specialty within their area.

Graduation
When a student is ready to graduate you will need to complete an Application for Degree form. These forms are available online through the portal. To access the form, log on to the Portal, click the Banner Icon, and click the Student Services tab. Applications must be submitted by the deadlines listed on the **Academic Calendar.** Once this form is complete, please see the Graduate Coordinator for additional requirements.

Core Requirements - All graduate students are expected to finish their core course requirements in the first two years in their program.

Masters Program Guidelines

The Electrical and Computer Engineering Department offers Master's degrees in Electrical Engineering, Computer Engineering, and Photonics.

Master's Degree

The MS degree is a 30 credit program. If you choose to do a Thesis, you will take up to 6 credits of thesis hours in place of 2 courses. Theses must be approved and submitted to the Registrar by the set deadline which can be found on the Academic Calendar. A print out of Thesis guidelines and sample signature and title pages can be obtained in the Department Office. The MEng degree does not require a thesis.

Candidates for the Master's degree have six years to complete their program. MS students may transfer up to 9 approved credits from a previous MS program into their Lehigh program as long as they have not been used for a previous degree. This can be accomplished by completing a petition form once you arrive. Lehigh undergraduates may transfer up to 6 credits of 300 or 400-level courses taken during their undergraduate studies. Please see the College Handbook for full rules regarding this policy. Each program has their own department requirements, and all programs within the P.C. Rossin College of Engineering and Applied Sciences must follow the college requirements as well. Check online for the College of Engineering Graduate Student Handbook.

The ECE Department has a core curriculum requirement for graduate students in each of the degree programs. The purpose of this requirement is to guarantee that all students pursuing graduate studies in the department acquire an appropriate breadth of knowledge of their discipline. Masters students may take up to 6 credits of Independent Study if not writing a thesis.

Requirements for Master of Engineering and Master of Science Degrees

In meeting the requirements for the Master of Science or Master of Engineering degree, the student must satisfy the following common requirements, as outlined in the Graduate Student Handbook.

1. All candidates for a Master's degree must submit the form entitled *Program for Master's Degree* as soon as possible after accruing 15 credit hours of courses but no later than the semester before the student graduates. This form is eventually approved by the Registrar. The timing for completion of this form is critical, as it allows for corrections to a student's course plan if necessary.

2. The minimum program for all Master's degrees includes:

- Not less than 30 credit hours of graduate work; audit credits may not be used toward the degree. Research or thesis registration counts as part of the 400-level course requirement.
- Not less than 24 credit hours of 300- and 400-level coursework of which at least 18 hours is at the 400-level.

- Not less than 18 credit hours in Electrical & Computer Engineering
- Not less than 15 credit hours of 400-level coursework in Electrical & Computer Engineering

3. Eighteen (18) credit hours in the major field of Electrical & Computer Engineering are required. These courses must be 300- and 400-level courses. The remaining twelve (12) credit hours may also be taken in Electrical & Computer Engineering (300- and 400-level courses), or they may be taken in any other field in engineering in which courses for graduate credit are offered, subject to the approval of the student's advisor.
4. A graduate student may include in his or her program courses numbered 200 or higher outside of the department and 300 or higher in the department. A graduate student registered in 200 or 300 level courses may be assigned additional work at the discretion of the instructors. Courses taken outside of the department are subject to approval by the advisor and the Departmental Graduate Committee.
5. The Master's degree is not granted unless the candidate has earned grades of B- or better in at least eighteen hours of the work in his/her program and in **all** 300-level courses in Electrical & Computer Engineering. No course in which the grade earned is less than C- is credited towards the degree.
6. A student who receives more than four grades below B- in courses numbered 200 or higher becomes ineligible to qualify for the Master's degree or to register for any other 400-level courses.

MS / MEng EE Department Requirements

To satisfy the core curriculum requirements in Electrical Engineering, students must select three (3) courses from the following five (5) different areas:

ECE 401 Advanced Computer Architecture
ECE 402 Advanced Electromagnetics
ECE 420 Advanced Circuits and Systems
ECE 441 Fundamentals of Wireless Communications /or/ ECE 414 Machine Learning and Statistical Decision Making
ECE 451 Physics of Semiconductor Devices

In addition to the three core courses, elective courses can be selected from the offered courses for that term.

Master of Science Degree in Photonics

The Master of Science Degree in Photonics is an interdisciplinary program designed to provide students with a broad training in the various aspects of photonics, including topics in electrical engineering, materials science, and physics. Admission to the program requires a B.S. or M.S. in either the engineering or physical sciences.

Applications should be directed to one of the three sponsoring departments (Electrical and Computer Engineering, Materials Science and Engineering, or Physics). Procedures and admission criteria are the same as those followed by the home department. International students must satisfy minimum university language requirements. The admissions process is under the supervision of the individual department to which you apply.

Required Courses*(15 credits):

PHY 352 (3 Credits)	Modern Optics (or PHY 482, Applied Optics)
PHY 355 (3 Credits)	Nonlinear Optics
ECE 402 (3 Credits)	Advanced Electromagnetics (or PHY 421, Elec & Magnetism I)
ECE 451 (3 Credits)	Physics of Semiconductor Devices (or PHY 363, Physics of Solids)
MAT 416 (3 Credits)	Optical Prop of Materials

Selected pre-requisites for the required courses may be waived by the program director for students with equivalent background.

A minimum of three courses must be selected from the following list:

ECE 425 (3 Credits)	Semiconductor Laser I
ECE 426 (3 Credits)	Semiconductor Laser II
ECE 438 (3 Credits)	Quantum Electronics
ECE 450 (3 Credits)	Nanophotonics & Plsmonics
ECE 450 (3 Credits)	Optoelectronic Phys & Lightwave
ECE 450 (3 Credits)	Introduction to Photovolaic Energy Systems
ECE 450 (3 Credits)	Applied Quantum Mechanics for Engineers
ECE 468 (3 Credits)	Biophotonics and Optical Biomedical Imaging
CSE 420 (3 Credits)	Biomedical Image Computing
MAT 302 (3 Credits)	Electronic Properties of Materials
MAT 334 (4 Credits)	Electron Microscopy & Microanalysis
MAT 427 (4 Credits)	Electron Microscopy (TEM and SEM)
PHY 331 (2 Credits)	Integrated Bioelectronics/Biophotonics Laboratory
PHY 422 (3 Credits)	Elec & Magnetism II
PHY 369 (3 Credits)	Quantum Mechanics I
PHY 424 (3 Credits)	Quantum Mechanics II

In order to complete the MS degree requirements of the University, candidates must submit either a Master's thesis or a report based on a research course of up to 6 credit hours. Research courses should be at the 400 level.

MS / MEng Computer Engineering Course Requirements:

To satisfy the Computer Engineering core, a student must complete, with a grade of B or higher, the following 4 courses:

ECE 319 Digital System Design
ECE 401 Advanced Computer Architecture
CSE 303 Operating System Design / or / CSE 403 Advanced Operating Systems
CSE 340 Design and Analysis of Algorithms / or / CSE 440 Advanced Algorithms / or / CSE 441 Advanced Algorithms

To satisfy the Computer Engineering MS/Ph.D. comprehensives/core listed above, a student must satisfy two requirements:

1. A student must complete, with a grade of B or higher, the 4 courses listed above.

2. A student must complete 2 courses in the Computer Hardware/Architecture area, 2 courses in a second area, and 1 course in a third area. In each of the three areas at least one course must be at the 400 level.

Please note that the courses in Requirement 1 can be used to satisfy Requirement 2. While some of the courses below are listed in multiple categories, they can be used in only one. Each category also allows for appropriate CSE and ECE special topics courses not listed below and equivalent courses taken at other schools, with approval of the computer engineering curriculum committee. Courses taken as part of an undergraduate degree maybe used to satisfy the core requirements.

Computer Hardware/Architecture:

- Digital System Design (ECE 319) *
- Embedded Systems (ECE 336)
- Introduction to VLSI Circuits (ECE 361)
- Principles of Practice of Parallel Computing (CSE 375/475)
- Advanced Computer Architecture (ECE 401) *
- VLSI Signal Processing (ECE 416)

Core Computer Software Systems:

- Compiler Design (CSE 302)
- Operating System Design (CSE 303) *
- Computer Graphics (CSE 313)
- Design and Analysis of Algorithms (CSE 340) *
- Fundamental of Internetworking (CSE 342)
- Network System Design (CSE 363)
- Principles of Practice of Parallel Computing (CSE 375/475)

- Advanced Operating Systems (CSE 403)
- Advanced Communication Networks (CSE 424)
- Object-Oriented Software Engineering (CSE 432)
- Advanced Algorithms (CSE 441) or CSE 498
- Network Security (CSE 343/443)
- Software Security System (CSE 334/434)
- Advanced Wireless Network (CSE 497)

Signal Processing and Communications:

- Digital Signal Processing (ECE 343)
- Communication Theory (ECE 342)
- Statistical Signal Processing (ECE 344)
- Fundamentals of DATA Network (ECE 345)
- Lightwave Technology (ECE 348)
- Optical Information Processing (ECE 371)
- Optical Networks (ECE 372)
- Digital Communication Systems (ECE 410)
- Information Theory (ECE 411)
- Signal Detection and Estimation (ECE 414)
- VLSI Signal Processing (ECE 416)
- Error-Correcting Codes (ECE 435)
- Fund. of Wireless Communications (ECE 341/441)

Computer Software Applications:

- Computer Graphics (CSE 313)
- Artificial Intelligence Theory and Practice (CSE 327)
- Multimedia Design and Development (CSE 332)
- Topics in Intelligent Decisions Support Systems (CSE 335)
- WWW Search Engines (CSE 345/445)
- Data Mining (CSE 347/447)
- Network Security (CSE 343/443)
- Introduction to Mobile Robotics (CSE 360/460)
- Introduction to Cryptography and Network Security (ECE 364/464)
- Principles of Practice of Parallel Computing (CSE 375)
- Computer Networks (ECE 404)
- Advanced Programming Techniques (CSE 411)
- Advanced Communication Networks (CSE 424)
- Bioinformatics: Issues and Algorithms (CSE 308/408)
- Semantic Web Topics (CSE 428)
- Pattern Recognition (CSE 326/426)
- Stochastic Models and Applications (ISE 429)

Circuits and Systems:

- Digital Systems Design (ECE 319) *
- Design of Linear Electronic Circuits (ECE 332)
- Mixed signal circuits (ECE 355)
- Embedded Systems (ECE 336)
- Introduction to VLSI Circuits (ECE 361)
- Advanced Circuits and Systems (ECE 420)
- Design of Microwave Solid State Circuits (ECE 463)
- Advanced Semiconductor Devices for VLSI Circuits (ECE 483)

Doctor of Philosophy Degree

A Ph.D. candidate is generally expected to devote three or more academic years to graduate study. In no case is the degree awarded to one who has spent less than two full academic years of graduate work.

All post-baccalaureate work toward the doctorate must be completed within 10 years. Doctoral students whose graduate study is carried out entirely at Lehigh University must register for a minimum of 72 credits beyond the Bachelor's degree. Students who have earned a Master's degree at another institution must register for a minimum of 48 credits.

All Ph.D. candidates are also required to complete the Core Course Requirements stated in the Master's section above.

Electrical Engineering Ph.D. candidates:

To satisfy the core curriculum requirements in Electrical Engineering, students must select three (3) courses from the following five (5) different areas:

ECE 401 Advanced Computer Architecture
ECE 402 Advanced Electromagnetics
ECE 420 Advanced Circuits and Systems
ECE 441 Fundamentals of Wireless Communications / or/ ECE 414 Machine Learning and Statistical Decision Making
ECE 451 Physics of Semiconductor Devices

Additionally, PhD candidates cannot take more than nine credits of the Independent Study courses.

Qualifier Exams for EE

All students in the Ph.D. program must take the appropriate Qualifier Exam in the spring following their first semester of study as a Ph.D. student. If a student is unable to fulfill this obligation, the Graduate Coordinator will need to be notified. This exam requires

demonstration of competency in selected areas. The exams are offered in six (6) different areas:

BioElectronics and BioPhotonics
Communications, Signal Processing and Networking
NanoElectronics and MEMS
Optoelectronics and Photonics Systems
Power Systems and Power Electronics
Computer Architecture and VSLI Design

Each area has an assigned faculty member who will oversee the examination and communicate with those students signed up for the exam. Exams will typically consist of reading assigned research papers, writing a response paper and taking an oral exam with the examining committee. The Examining Committee will consist of at least three faculty members. The topics can be related to one's research thrust, but not identical to the thesis topic.

The exam is on a pass/fail basis. Students who do not pass the exam the first time will be able to take the exam again after a 5 month waiting period. This will be organized with the help of the Graduate Coordinator and the Qualifier Committee involved on an individual basis. If a student fails to retake the Qualifier Exam within a 12 month period, that student will be removed from the Ph.D. program, and will be forced to reapply. If a student does not pass after the second attempt they will be unable to continue in the Ph.D. program.

Admission to Candidacy

Once a Ph.D. student has passed his/her Qualifier Exam he/she may begin preparing to apply for Candidacy. An information packet on the application process can be picked up in the Department Office. This information must be complete and submitted to the Associate Dean's office two (2) weeks prior to the start of the semester. A prospective candidate must submit a written program proposal to their **Doctoral Committee** (guidelines on the formation and membership of this committee can be found in the College Handbook) that includes a discussion of proposed dissertation research. Once the Committee approves the proposal, the candidate submits the proposal along with a completed signature page and the Application to Candidacy form to the College of Engineering Graduate Dean's Office. The Dean's office will then notify the student and their committee members in writing of the decision.

Once the student has completed their credit hour requirement for the Ph.D. degree (72 or 48) they may apply for Maintenance of Candidacy two times per year from that point on. This means that the student is only required to be registered for one (1) credit Maintenance of Candidacy from that point on until they complete their program.

General Exam

The general examination for the doctorate is designed to test both the student's capacity and his or her proficiency in the field of study. The examination is not necessarily confined to the content of courses that have been taken at Lehigh University or

elsewhere. The examination is held, no later than seven months prior to the time when the candidate plans to receive the degree. The student's doctoral committee is in charge of the examination, which may be both written and oral.

Should a candidate fail in the general examination, he or she may be permitted by the doctoral committee to present him or herself for a second examination not earlier than five months after the first. If the results of the second trial are also unsatisfactory, no further examination is set and the candidate is judged to have failed.

Dissertation and Defense

Ph.D. candidates are required to write a dissertation prepared under the direction of their advisor (also typically the Chair of their Doctoral Committee). Guidelines can be found in the College Handbook and all associated dates are listed on the **Academic Calendar**.

A print out of guidelines and sample title and signature pages can also be obtained in the Department Office.

Computer Engineering Ph.D.

Candidates must complete the Core Requirements in the Master's section which can be found at the following web address:

https://engineering.lehigh.edu/ece/ece-graduate-studies/degree-requirements

General College guidelines and requirements for the Ph.D. degree can be found in the College Graduate Student Handbook which can be found online.

https://engineering.lehigh.edu/sites/engineering.lehigh.edu/files/pdf/academics/graduate/graduate_student_handbook.pdf

Computer Engineering Ph.D**.** students may also take a qualifier in additional areas more specific to their research as long as they have three faculty members in either the Electrical & Computer Engineering Department or Computer Science & Engineering Department agree to form a committee to offer the specific exam.

The exam is on a pass/fail basis. Students who do not pass the exam the first time will be able to take the exam again after a 5 month waiting period. This will be organized with the help of the Graduate Coordinator and the Qualifier Committee involved on an individual basis. If a student fails to retake the Qualifier Exam within a 12 month period, that student will be removed from the Ph.D. program, and will be forced to reapply. If a student does not pass after the second attempt they will be unable to continue in the Ph.D. program.