University of Southern California

Ming Hsieh Department of
Electrical and Computer Engineering

Graduate Student Handbook

PhD in Electrical and Computer Engineering
and
PhD in Computer Engineering

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Contents

1. Introduction

Welcome to the PhD program. Please refer to this document for guidance on what you will need to do to complete the requirements for the PhD in Electrical and Computer Engineering or the PhD in Computer Engineering. The guidance below applies to all students matriculating Fall 2025 or later, until such time that a new version of this handbook is released.

To complete the PhD you will need to meet the following requirements:

a. Complete a minimum of 60 academic units with a minimum coursework requirement as described below (Section 3). You must also take the 1 unit EE 698 Doctoral Seminar Series in the Fall semester of your first year in the program as part of the 60 required units.
b. Pass the PhD Screening Exam in one of three areas of interest as described below (Section 4).
c. Pass the PhD Qualifying Exam within four years of entering the program as described below (Section 5).
d. Pass your PhD Defense and submit the final version of your PhD Thesis to the Graduate School (Section 6).

The majority of your time as a PhD student will be spent on completing and writing up the research in your PhD Thesis. To do so you need to find a PhD Advisor willing to supervise your research. See Section 2 for suggestions on finding a PhD Advisor as well as rules for selecting your PhD Qualifying Committee and your PhD Defense Committee.

To ensure that all students are progressing satisfactorily through the PhD program, each student must complete a progress report each semester. The department will review your report and an evaluation from your PhD advisor and provide feedback on whether your progress meets expectations. If your progress is judged not to be satisfactory, we will provide guidance as to what you need to do to address this.

<u>Information for students who entered the PhD program prior to Fall of 2025</u>

Your degree requirements are listed in the USC Catalog for the Academic Year in which you matriculated. The PhD in Electrical and Computer Engineering has a different set of course requirements than the PhD in Computer Engineering. The Computer Engineering courses are centered around hardware, software, systems, and theory areas, as noted in the USC Catalog.

We encourage you to follow the processes described below to the degree that is consistent with your current progress through the program. Please note the following:

a. Previous minor requirements will no longer be enforced effective 8/15/2025.

b. While the minor requirement is no longer in effect, we strongly encourage all students to follow the minimum coursework requirements listed below in Section 3.

c. As we transition to the new Screening Exam format, we will provide specific guidance with respect to the PhD Screening Exam for students who entered the program prior to Fall 2025.

d. For students who have not yet passed the PhD Qualifying Exam and are in year 5 or more of their program, we urge you to work with your faculty advisor to take the PhD Qualifying Exam as soon as possible.

2. Finding a PhD Advisor and Forming your Qualifying & Defense Committees

One of the most important decisions of your PhD is in finding an advisor. If you received a Fellowship for your first year in the PhD program you are free to rotate through two or three labs or research groups (with the consent of the associated faculty members) before making a decision. Alternatively, if you have already made arrangements to join a particular research group, you can do so immediately. Rotations are not required.

If you joined USC as a Research Assistant, then you are required to work with the faculty member providing the RA support, at least for your first year. You are free to change advisors after one year provided you make arrangements for financial support with your new advisor.

It is important that all PhD students identify a PhD advisor by the end of your first academic year and make arrangements for financial support (RA, TA or other) for your second year.

On rare occasions students may decide to change PhD advisors. If this situation arises, you should seek advice from the Department Chair or Vice Chair, the Associate Chair for Graduate Affairs, or the Director of Student Services.

PhD Advisor: your PhD advisor must be a tenured, tenure-track or research professor with a primary appointment in the Ming Hsieh Department of Electrical and Computer Engineering or a tenured/tenure-track professor from another department at USC who holds a courtesy joint appointment in ECE.

Qualifying Exam Committee: consists of five persons, including at least three with a primary appointment in ECE, of which a minimum of two must be tenured or tenure-track faculty. One outside member must be a tenured/tenure-track faculty member with primary appointment in a USC department other than ECE; T/TT faculty with courtesy appointments in ECE may serve as the outside member. The policy of the USC Graduate School is that qualifying committees can only have five members.

Dissertation Defense Commitee: consists of a minimum of three persons and a maximum of five, including at least two with primary appointment in ECE, of which at least one must be tenured or tenure-track faculty, and at least one outside member who is a tenured/tenure-track faculty member with primary appointment in a USC department other than ECE. T/TT faculty with courtesy appointments in ECE may serve as the outside member.

Note: the outside member of the qualifying and defense committees must be a full-time tenured/tenure-track faculty member at USC with the authority to chair a PhD committee in his or her home department/school. It is particularly important to check this for faculty from the Keck School of Medicine, many of whom do not have this privilege.

3. Coursework requirements

Prior to taking the PhD Qualifying Exam, all students in the PhD program in Electrical and Computer Engineering and the PhD program in Computer Engineering must complete a minimum of 28 units of advisor-approved technical coursework that is applicable to the 60 units required to complete the PhD. A maximum of 8 of the 28 units can be from 400 level classes. While graduate coursework can be transferred from other institutions, a minimum of 16 coursework units at the 500 or 600 level must be taken in residence at USC. These coursework unit requirements exclude directed research (EE 590, EE 690, EE 790). In addition, the PhD in Computer Engineering degree must satisfy the course requirements as listed in the USC Catalog.

Exceptions to this policy will be evaluated by the Department's PhD Affairs Committee based on a petition by the student.

Additional requirements for students in the Computer Engineering PhD program: students in this program should refer to the 2025-2026 USC Catalog Description of the PhD in Computer Engineering in which specific additional course requirements in terms of specific areas are described. These requirements can and must be satisfied in parallel with the PhD Screening Exam and Minimum Coursework requirements listed below.

4. The PhD Screening Exam

Objectives
The Ph.D. Screening Exam is designed to evaluate and support Ph.D. students in two key areas:

- Technical Competency– Assessing mastery of core topics that encompass both the fundamentals of the student's primary research area and related courses in one or more subject-areas.

- Research Readiness– Evaluating the student's ability to function as an independent researcher, particularly in presenting and defending technical content in a conference-style setting.

Technical competency is determined based on coursework taken in one of three areas of specialization. Please refer to Appendix A for details on the areas of specialization and associated coursework requirements for the Screening Exam.

<u>Exam Structure</u>
The Screening Exam consists of the following components:

a. Coursework Performance
  - Each student must complete 4 approved courses for credit with a grade of B or higher. The list of approved courses for each area is provided in Appendix A. If a student has taken one of the equivalent required courses during his or her BS or MS studies, he/she can take the final exam for that course without taking the course. The final exam grade will then be used in the PhD exam course screening GPA calculations. All students must take a minimum of 3 approved courses at USC for credit prior to the PhD screening.

  - If students take more than the minimum number of approved courses, eligible courses with the highest grade will be considered for the purpose of Ph.D. screening.

  - Based on the cumulative GPA across these courses:
    1. GPA > 3.7 Passes the course requirement for Ph.D. screening
    2. GPA < 3.3 Fails the course requirement for Ph.D. screening
    3. 3.3 < GPA < 3.7 an oral exam will be given on those courses in which students receive less than A-. Details are provided in the Oral Presentation section.

b. Oral Presentation
  - All students will present a research overview to a committee of three faculty members assigned by the department, one of whom may be the student's Ph.D. advisor. The research overview may comprise literature survey and/or original research conducted by the student at the time of the exam. Students are expected to demonstrate the application of fundamental concepts, possibly acquired through coursework, in research. The student will have 15 minutes to present, followed by 15 minutes of Q&A. The members of the committee will each evaluate the student's performance in the exam.

- Students whose GPA falls between 3.3 and 3.7 will also be questioned on the course material for courses with letter grade lower than A-. This part of the exam will be administered by the same committee of three faculty over an additional 30-60 minutes. If the student has received a grade lower than A- in several courses, the committee may test the student in any or all of those course topics at their discretion.

Pass/Fail Decision

The student's record, consisting of the coursework performance, research oral presentation, and coursework oral test (if applicable), as well as input from the research advisor, will be used as the basis for making a pass/fail decision. The department's decision is final.

Timeline, Retaking of Orals, and Petitions

- The course requirements must be completed prior to the semester in which students take the oral portion of the Screening Exam.

- The oral presentation and coursework test (if applicable) will take place in the first two months of the fourth (Spring) semester. (Students who begin the program in the spring semester must take and pass the Screening Exam in their fifth semester).

- Students who fail the oral presentation will be given the opportunity to retake the oral portion of the exam before the end of the fourth semester.

- Students who have not passed the Screening Exam by the end of the fourth semester will not be permitted to continue in the Ph.D. program.

- Appeals and exceptions to the process described above will be handled through a student-initiated petition to the PhD Student Affairs Committee.

5. The PhD Qualifying Exam

All students in the PhD programs in Electrical Engineering and Computer Engineering must take the Qualifying Exam by the end of their 4th year in the PhD program. Any exceptions to extend the period by one year must be submitted no later Drop/Add day of the 2nd semester of your 4th year. Such requests will be evaluated by the Department's PhD Affairs Committee based on a petition by the student.

The Qualifying Exam lasts between one to two hours and consists of a seminar-style presentation of the student's research to date together with a plan for what will be completed by the time the

student is ready to graduate. It is common for committee members to ask questions during the presentation. An additional Q&A session follows the student's presentation.

The committee will ask the student to leave the room to deliberate and come to a decision on whether the student has passed the exam. The student is then invited back in and informed of the result of the exam. The committee may also ask the student to step out for a couple of minutes prior to the Exam start so the advisor can discuss any relevant issues about the student and answer questions from the committee.

The student must prepare a written Thesis Proposal as a part of the Exam. This must be shared with the committee no less than one week prior to the Exam. The proposal typically contains an introduction, chapters/papers describing work completed to date, and a final chapter on plans for work to complete the PhD. This document often serves as an initial draft for the final thesis.

Plan for at least three weeks before the Qual Exam, to complete the PhD Committee System and Forms at https://myviterbi.usc.edu/ and upload your documents. This is the typical processing time for the committee to sign the form and process your request. If the committee has not been approved by the Dean or you have not uploaded your documents at least 7 days before the proposed exam date, you will not be able to take the exam at the scheduled time, and a new date will need to be agreed upon and entered into https://myviterbi.usc.edu/

Documents to upload:

  • Thesis proposal document
  • Pointers to, or copies of, relevant publications
  • Current curriculum vitae (CV), including a listing of relevant graduate coursework and grades

The Qualifying Exam Committee consists of five persons, including at least three with a primary appointment in ECE, of which a minimum of two must be tenured or tenure-track faculty. One outside member must be a tenured/tenure-track faculty member with primary appointment in a USC department other than ECE; T/TT faculty with courtesy appointments in ECE may serve as the outside member. The policy of the USC Graduate School is that qualifying committees can only have five members.

Note: the outside member of the qualifying and defense committees must be a full-time tenured/tenure-track faculty member at USC with the authority to chair a PhD committee in his or her home department/school. It is particularly important to check this for faculty from the Keck School of Medicine, many of whom do not have this privilege.

After the Committee Form has been signed by the Department Chair and the Viterbi Dean, a Report on PhD Qualifying Exam will be generated by the PhD Committee System and Forms system and sent to the committee (starting with your advisor) for the exam results.

Registration is required in EE 794a and EE 794b in consecutive semesters after passing the Qualifying Exam in order to defend. Continued registration is required in 794c, d, and z in subsequent semesters after having passed the exam, until the dissertation is defended. The maximum number of EE 794 units is 8 (2 units each), with EE 794z being 0 units. All EE 794 registrations give students full time student status each semester.

6. The PhD Defense

The final steps of the process for the PhD are the completion of your PhD dissertation and the oral defense exam, which is open to the public. Your Dissertation Defense Committee consists of a minimum of three persons and a maximum of five, including at least two with primary appointment in ECE, of which at least one must be tenured or tenure-track faculty, and at least one outside member who is a tenured/tenure-track faculty member with primary appointment in a USC department other than ECE. T/TT faculty with courtesy appointments in ECE may serve as the outside member.

Note: the outside member of the qualifying and defense committees must be a full-time tenured/tenure-track faculty member at USC with the authority to chair a PhD committee in his or her home department/school. It is particularly important to check this for faculty from the Keck School of Medicine, many of whom do not have this privilege.

Plan for at least three weeks before the Defense Exam, to complete the PhD Committee System and Forms at https://myviterbi.usc.edu/ and upload your documents. This is the typical processing time for the committee to sign the form and process your request. If the Defense Committee has not been approved by the Dean or you have not uploaded your documents at least 7 days before the proposed exam date, you will not be able to take the exam at the scheduled time and a new date will need to be agreed upon and entered into https://myviterbi.usc.edu/ The student should additionally provide their advisor's administrative assistant and/or Student Services office with the following information about the defense so that it may be publicly posted a week in advance of the exam:

- Name
- Dissertation Title
- Dissertation Abstract
- Room for Defense
- Time

When you have passed your defense, the faculty will be notified to input the results of your exam into the form.

Prior to taking the defense, please check with the ECE Student Services Advisors to ensure you have completed all the requirements for the PhD. Once you have taken and passed the PhD defense, please check with the ECE Student Services Advisors to make sure that your STARS is updated.

In addition to the https://myviterbi.usc.edu/ forms all students must also complete the USC Graduate School's Thesis Center form here:

https://graduateschool.usc.edu/current-students/thesis-dissertation-submission/

Please read the directions and follow the steps for completion. Note that the completed Defense Committee form from PhD Committee System and Forms system needs to be uploaded to the Graduate School's Thesis Center system as part of their "checklist".

Appendix   Screening Exam Course Requirements

The following pages contain the breakdown of the screening exam area courses and are arranged by the focus areas. Please refer to the specific instructions for each exam area.

Electrophysics

Students must take a total of four (4) courses from the lists below. This must include two courses from the **FUNDAMENTALS** category and two courses from the **SUBJECT AREA** categories.

FUNDAMENTALS

EE 570a Advanced Electromagnetic Theory

Or (but not both)

EE 572L Electromagnetic Wave Engineering

EE 536a Analog Integrated Circuits
EE 539 Engineering Quantum Mechanics

EE 503 Probability for Electrical and Computer Engineers

Or (but not both)

EE 510 Linear Algebra for Engineering

SUBJECT AREAS

Electromagnetics

EE 535 Wireless Communications
EE 551 Principles of Radar
EE 562 Random Processes in Engineering
EE 571 Wave Interactions with Random and Inhomogenous Media
EE 572L Electromagnetic Wave Engineering
EE 578 Computational Electromagnetics for Engineers

Materials, Devices and Circuits

EE 507 Micro- and Nano-Fabrication Technology
EE 508 Hardware Foundations of Machine Learning
EE 536a Analog Integrated Circuits
EE 536b Analog Integrated Circuits
EE 539 Engineering Quantum Mechanics
EE 549 Nanotechnology for Materials, Electronics, and Circuits
EE 576 Integrated Memory Devices and Technologies
EE 577a VLSI System Design
EE 607 Microelectromechanical Systems
EE 631 Mixed-Signal Integrated Circuits
EE 632 Integrated Communication Systems
EE/MASC 501 Solid State

Quantum, Optics and Photonics

EE 506 Semiconductor Physics
EE 509 Nanophotonics and Metamaterials
EE 514 Quantum Error Correction
EE 515 Quantum Sensing: Machine Learning, Inference and Information
EE 520 Introduction to Quantum Information Processing
EE 529 Optics
EE 531 Nonlinear Optics
EE 540 Introduction to Quantum Electronics

Signals and Systems

Students must take a total of four (4) courses from the lists below. This must include at least one from the **FUNDAMENTALS** category and a minimum of one from at least two of the **SUBJECT AREAS** categories.

FUNDAMENTALS

EE 503 Probability for Electrical and Computer Engineers
EE 510 Linear Algebra for Engineering
EE 517 Statistics and Data Analysis for Engineers
EE 562 Random Processes in Engineering
EE 588 Optimization for the Information and Data Sciences

SUBJECT AREAS

Control and Autonomous Systems	Quantum Information Processing	Communications & Information Theory	Machine Learning	Signal Processing
EE 482 Linear Control Systems **EE 543** Digital Control Systems **EE 585** Linear System Theory **EE 587** Nonlinear Control Systems **EE 593** Robust Multivariable Control	**EE 514** Quantum Error Correction **EE 515** Quantum Sensing: Machine Learning, Inference and Information **EE 520** Introduction to Quantum Information Processing	**EE 467** Introduction to Communication Systems **EE 535** Wireless Communications **EE 550** Data Networks: Design and Analysis **EE 564** Digital Communication and Coding Systems **EE 565** Information Theory and Its Application to (Big) Data Sciences	**EE 556** Stochastic Systems and Reinforcement Learning **EE 559** Machine Learning I: Supervised Methods **EE 660** Machine Learning II: Mathematical Foundations and Methods **EE 689** Computational Intelligence and Neural Learning	**EE 483** Introduction to Digital Signal Processing **EE 563** Inference and Estimation: Theory and Algorithms **EE 592** Computational Methods for Inverse Problems **EE 596** Wavelets and Graphs for Signal Processing and Machine Learning

Computer Engineering

Students must take a total of four (4) courses from the lists below. This must include at least one course from the **FUNDAMENTALS** category and one course from the **SUBJECT AREA** categories. Students may substitute at most one course from the **Signals and Systems** or **Electrophysics** screening exam course lists.

FUNDAMENTALS

EE 450 Introduction to Computer Networks
EE 451 Parallel and Distributed Computation
EE 457 Computer Systems Organization
EE 467 Introduction to Communication Systems
EE 477 MOS VLSI Circuit Design

EE 503 Probability for Electrical and Computer Engineers
EE 510 Linear Algebra for Engineering
CSCI 402 Operating Systems
CSCI 570 Analysis of Algorithms
CSCI 670x Advanced Analysis of Algorithms

SUBJECT AREAS

Computer Architecture

EE 454L Introduction to System-on-Chip
EE 542 Internet and Cloud Computing
EE 554 Cyber-Physical Systems: A Computing Perspective
EE 557 Computer Systems Architecture
EE 568 Parallel Programming
EE 653 Advanced Topics in Microarchitectures
EE 677 Accelerated Computing using Field Programmable Gate Arrays

Hardware Systems Design

EE 536a Analog Integrated Circuits
EE 536b Analog Integrated Circuits
EE 552 Asynchronous VLSI Design
EE 576 Integrated Memory Devices and Technologies
EE 577a VLSI System Design
EE 578 Computational Electromagnetics for Engineers
EE 581 Mathematical Foundations for System Design: Modeling, Analysis and Synthesis
EE 595 Software Design and Optimization
EE 658 Diagnosis and Design of Reliable Digital Systems
EE 680 Computer-Aided Design of Digital Systems

Distributed Systems

EE 512 Stochastic Processes for Financial Engineering
EE 550 Data Networks: Design and Analysis
EE 555 Broadband Network Architectures
EE 597 Wireless Networks
EE 649 Stochastic Network Optimization and Adaptive Learning
CSCI 530 Security Systems
CSCI 551 Computer Networking
CSCI 555L Advanced Operating Systems
CSCI 573 Probabilistic Reasoning
CSCI 651 Advanced Computer Networking
CSCI 671 Randomized Algorithms
CSCI 672 Approximation Algorithms
CSCI 673 Structure and Dynamics of Networked Information
CSCI 675 Convex and Combinatorial Optimization
ISE 530 Optimization Methods for Analytics
ISE 632 Network Flows and Combinatorial Optimization
MATH 505a Applied Probability
MATH 505b Applied Probability

AI and Machine Learning

EE 559 Machine Learning I: Supervised Methods
EE 660 Machine Learning II: Mathematical Foundations and Methods
CSCI 561 Foundations of Artificial Intelligence
CSCI 567 Machine Learning
CSCI 678 Theoretical Machine Learning
ISE 633 Large Scale Optimization and Machine Learning