

ECE-EP Graduate Screening Exam Handbook¹

This document is only applicable to students enrolled on the ECE-EP PhD program, and on or after the Fall 2023 academic semester.

Introduction

This Electrical and Computer Engineering–Electrophysics (ECE–EP) Graduate Screening Exam handbook has been created to assist ECE students, desiring to pursue the PhD in ECE–EP, with their preparation and completion of the Graduate Screening Exam process. Note that this document discusses mainly the ECE-EP Screening Exam and its requirements; please refer to the USC Graduate School section of the current USC Course Catalogue (available at <http://catalogue.usc.edu>) for additional PhD requirements.

This document has four sections: Sec. I describes the Screening Exam and its format; Sec. II discusses the exam core courses, Sec. III presents some frequently asked questions and their answers, and Sec. IV provides a list of current ECE-EP faculty members and their corresponding areas of interest.

The information described herein pertains only to the ECE–EP Graduate Screening Exam. The same procedures may not be in use in Electrical Engineering–Systems (ECE-S), nor does successful completion of the Graduate Screening Exam in ECE-EP automatically substitute for the Graduate Screening Exam in ECE-S, or vice versa.

Considerable effort had been made to render this handbook comprehensive, clear, and accurate. In spite of this fact, it can be anticipated that situations will occur where questions and interpretations of the material here presented will arise. In these cases, the current Chair of the ECE–EP PhD Affairs committee (Prof. Aluizio Prata) should be contacted directly.

¹ Updated on April 19, 2023

Section I - The ECE-EP Graduate Screening Exam and its Format

The ECE–EP Graduate Screening Exam is an academic process that serves as an entrance exam for the PhD in ECE-EP. Its primary purpose is to assure a minimum broad level of proficiency with Electrical Engineering matters, as perceived by the ECE-EP department faculty. It is the basis of your recommendation for formal acceptance into the PhD program on behalf of the department to the Graduate School. The Graduate Screening Exam is mandatory for all aspiring PhD students admitted in ECE–EP. This Section describes the various components of the ECE-EP Screening Exam.

The total duration of the ECE-EP Screening Exam is three academic semesters (not including Summer terms), counted immediately after admission into the PhD program. At the end of these three semesters your progress will be evaluated by the Screening Exam Committee. To pass the Screening Exam you need to successfully satisfy three requirements:

- 1) Complete a minimum of four core courses², and satisfy the necessary GPA requirement;
- 2) Complete a minimum of six 500 or higher-level classes, adding to a minimum of 24 units and not including Directed Research. The non-core classes must have a minimum letter grade of “B”;
- 3) Secure a PhD advisor.

Below more details are provided on these three items and their successful completion criteria.

Core Course Requirement

To pass the Screening Exam you are required to have successfully completed, at the end of the first three semesters of the PhD program, a minimum of four core courses. The list of core courses, and their selection criteria, is provided in Sec. II. These classes are referred to as Group A and B classes.

Your progress in the four core courses is determined using the GPA of only the four core courses; this core course GPA is considered your Screening Exam GPA. In the encouraged event that you have taken more than four core courses, the Screening Exam GPA is computed using the core courses in which you have obtained the highest grades.

To *summarily* pass the core course requirement you must take four core courses and secure a minimum GPA of 3.700 on these courses. This must be done by the end of your first three semesters in the PhD program.

² The core courses are discussed in Sec. II of this handbook.

You will *summarily* fail the Screening Exam if your GPA in the core courses is below 3.300, or if you do not complete the four core courses before end of your first three semesters in the PhD program.

If your Screening Exam GPA is found to be between 3.300 and 3.700, at the end of your first three semesters in the PhD program, the entire ECE-EP faculty will review your academic progress, and determine whether you have passed or failed the Screening Exam.

500 or Higher-Level Classes Requirement

To pass the Screening Exam you are required to have successfully completed, by the end of the first three semesters of the PhD program, a minimum of two 500 or higher-level courses, in addition to the four core courses. For Screening Exam purposes, Directed Research is not considered a 500 or higher level course. These classes are referred to as Group C classes.

To count towards the Screening Exam, the 500 or higher level Group C classes must be selected from the classes offered by either the Viterbi School of Engineering, or by the departments of Biological Sciences, Chemistry, Mathematics, or Physics. Please note that PhD students are allowed to take courses outside these departments, and they can in principle count towards the PhD. However, to count towards the Screening Exam Group C course requirement, classes taken outside these departments require previous approval by the ECE-EP PhD Affairs committee.

The Group C class requirement is considered satisfied if you have completed all its classes with at least a “B” letter grade; a simple Pass grade is not acceptable. Note that this minimum “B” grade requirement pertains only to the Screening Exam, and the Graduate School may have additional GPA requirements for granting the PhD.

PhD Advisor Requirement

As part of your Screening Exam effort you must review the research areas of each faculty of the ECE–EP department, with the objective of establishing mutual areas of interest. You should then meet individually with the professors of your interest, to discuss the possibility of having one of them support you as a PhD student. Section IV of this handbook lists the ECE-EP faculty and their corresponding areas of interest.

Some students may decide to work with advisors outside the ECE–EP Department. A special permission is required in these cases, and must be obtained from the ECE–EP PhD Affairs Committee, prior to completing the Graduate Screening Exam process.

The PhD advisor requirement is considered satisfied if, at the end of your first three semesters in the PhD program, a faculty has agreed to support you towards the PhD.

Graduate Screening Exam Pass-Fail Decision Criteria

After completing the Screening Exam you will find yourself in one of the following three pass-fail categories:

- 1) **Summarily Pass:** A minimum GPA of 3.700 in the four core courses (Group A and B classes), completion of two additional 500 or higher-level classes (not including Directed Research) with a minimum letter grade of “B” in each course (Group C classes), plus a PhD advisor;
- 2) **Summarily Fail:** A GPA below 3.300 in the four core courses (Group A and B classes), or completion of fewer than six 500 or higher-level classes, or no PhD advisor;
- 3) **Faculty Decision:** A GPA between 3.300 and 3.699 in the four core courses (Group A and B classes), completion of two additional 500 or higher-level classes (not including Directed Research) with a minimum letter grade of “B” in each course (Group C classes), plus a PhD advisor;

Section II - Core Courses

Successful completion of four core courses is required to pass the Screening Exam. Two courses must be from the current three major areas of interest of ECE–EP (Group A); these two courses are intended to provide useful basic general knowledge. The third and fourth courses are intended to provide either a strong engineering background or additional depth in a chosen area of specialization (Group B).

Group A - Pick two out of these three major areas courses:

EE 536a	Analog Integrated Circuits
EE 539	Engineering Quantum Mechanics
EE 570a	Advanced Electromagnetic Theory

Group B - Pick a third and a fourth course from either the above list or from:

EE 506	Semiconductor Physics
EE 509	Nanophotonics and Metamaterials
EE 531	Non-Linear Optics
EE 540	Introduction to Quantum Electronics
EE 570b	Advanced Electromagnetic Theory
EE 607	Microelectromechanical Systems
EE 631	Mixed Signal Integrated Circuits
EE/MASC 501	Solid State Physics
EE 503	Probability for Electrical and Computer Engineers
EE 577a	VLSI System Design
PHY 510	Methods of Theoretical Physics

It is very important that you maintain a sufficiently high GPA in the above courses. It is therefore important to be sure that you have adequate preparation before signing up for a core course. You will have only one chance to take any particular course from the above list. In order to help you make the decision of whether or not to start with a Graduate Screening Exam course or one of its prerequisites, please consult the USC catalogue. You are also strongly encouraged to directly contact the faculty teaching the course. Furthermore, it is important to attend the advisement meeting upon your entry into the Graduate Screening Exam procedure.

Section III – Commonly asked questions and their answers

How and when can I sign up for the Graduate Screening Exam?

Upon admission to the PhD program in ECE you are automatically considered enrolled in the process of taking the ECE Screening Exam. However, in order to assure proper communication with the ECE-EP PhD Affairs committee (e.g., relevant emails are periodically sent out to the students), it is required that you contact the ECE Student Services Office (located in EEB 102) and sign up for either the ECE-EP or the ECE-S Graduate Screening Exam at <https://myviterbi.usc.edu> (note that access to this site only becomes available after you have registered for the first semester of classes). By doing this you will also assure that all your contact information is current. This registration should be done as early as possible, and before the end of your first semester into the PhD program. After the first semester any registration changes require approval by the ECE-EP PhD Affairs committee. Please keep in mind that, independently of registration, your Graduate Screening Exam automatically starts upon your admission into the ECE PhD program.

Who needs to take the Graduate Screening Exam?

All ECE-EP students are required to take the ECE-EP Graduate Screening Exam, and the exam is available only to students admitted into ECE-EP. Students from other departments are required to take the Graduate Screening Exam of their corresponding departments. However, in some rare cases, and depending on the specific research area of interest, an ECE-EP student may be given the permission to take the ECE-S Graduate Screening exam instead, or an ECE-S student may be given the permission to take the ECE-EP Graduate Screening Exam instead. These exceptional cases are handled by the ECE-EP PhD Affairs committee, and are individually reviewed and approved or rejected ahead of time. Also, once the Graduate Screening Exam process is initiated in either ECE-EP or ECE-Systems, it must to be completed where it was initiated.

How long do I have to complete the Graduate Screening Exam process?

Once you have been admitted to the PhD program you must complete the Screening Exam process within three semesters. For example, if you start the PhD program in the Fall 2023 term you need to complete the Screening Exam process by the end of the Fall 2024 term. Exceptions to this rule are made only at the discretion of the ECE-EP PhD Affairs

committee. Note that your ECE PhD admission date is considered the official starting date of your Graduate Screening Exam process.

In some rare cases, a need to take core classes' prerequisites can render the three semesters Screening Exam completion deadline impractical. These cases are handled by the ECE-EP PhD Affairs committee on an individual basis, and it is the student's responsibility to approach the ECE-EP PhD Affairs committee about any problems early in the Screening Exam process.

How should I prepare for the Graduate Screening Exam?

To prepare for the Graduate Screening Exam it is very important to make sure that you receive proper advisement. Please make then sure that you attend any relevant information meetings at the beginning of your first academic year in the program. One of the purposes of these meetings is to explain the assumed background for each of the core courses. This will enable you to determine whether or not you need to take an appropriate prerequisite course before a particular core course. Passing the Graduate Screening Exam requires a high GPA in the core courses and you are only allowed to take each course once. It is important, therefore, that you have adequate academic preparation before signing up for a core course.

Overall you need to take a minimum of six 500 or higher-level courses, and you should also be in the process of choosing a research direction. For this last reason the Graduate Screening Exam requires that you secure a PhD advisor.

How is the Screening Exam GPA calculated?

The Screening Exam GPA (i.e., the GPA of the four Core Courses of Groups A and B) is calculated using the same formula that is used to determine any other USC GPA. To be sure, you can easily check your GPA by accessing the MS-Excel spreadsheet calculator available on the website

<https://dornsife.usc.edu/assets/sites/238/docs/undergraduate/forms/ScienceGPACalculator.xls>.

As examples, and considering that all classes have four units, here are some representative GPA results:

Grades on the four core courses	GPA
A-, A-, A-, A-	3.700
A, A, B+, B+	3.650
A, B+, B+, B	3.400
B+, B+, B+, B+	3.300

How do I *summarily* pass the Graduate Screening Exam?

To summarily pass the Screening Exam (and this is the most desirable option) you need to satisfy the following three requirements by the end of your third semester into the PhD program:

- (1) Complete the Graduate Screening Exam core courses (i.e., the classes selected from Groups A and B) with a Screening Exam GPA that is at least 3.700. In the event that your successful completion of these courses requires that you take appropriate prerequisite classes, sometimes adjustments can be made in the length of time nominally required for you to complete the entire Graduate Screening Exam process.
- (2) Complete at least six 500 or higher-level courses for a total of 24 units (not including Directed Research). These are classes taken from Groups A, B, and C. Each Group C class must have a minimum letter grade of B.
- (3) Secure a PhD advisor.

How do I select a faculty advisor?

One of the most important parts of a faculty member's responsibilities is the guidance, mentoring, and involvement of graduate students in state-of-the-art research activities. They are available to work with students. You are strongly encouraged to contact ECE-EP faculty who are working in the areas in which you wish to pursue your thesis research. It is a good idea to make an appointment and be prepared to discuss your ideas. This direct interaction with faculty is one of the best ways to learn about opportunities for selecting a faculty advisor. Also useful is to take classes offered by the faculty associated with your research areas of interest, as well as attend technical seminars.

Technical seminars covering various aspects of ECE-EP research are held frequently throughout campus. All ECE-EP students pursuing their PhD receive email seminar notices from the department. Additionally, advertisements are posted in the PHE and EEB buildings, and around several other buildings of the Viterbi School of Engineering. Attending these seminars will keep you posted on state-of-the-art matters relevant to ECE areas of interest. This is an important part of your PhD education, and will increase your capability of selecting an appropriate PhD advisor.

What if I wish to transfer a course that I have taken outside USC?

If you have taken courses outside USC and you would like to transfer them for credit, then the normal Graduate School procedure for obtaining credit for transfer courses applies. However, academic credit for these courses does not necessarily mean that you will be given subject credit for these courses in the Graduate Screening Exam procedure. If you wish to obtain Graduate Screening Exam credit for a transfer course you must pass the final exam of the corresponding course in the ECE department with a grade of B or better (please contact the faculty currently teaching the course and make the necessary arrangements). Your grade, for purposes of calculating your Graduate Screening Exam GPA, is the grade

you received on the corresponding USC course final exam. Note that you will not be penalized if you take a USC course final exam and do not pass. However, you still must successfully complete all the Graduate Screening Exam course requirements.

How many students will pass the Graduate Screening Exam?

Currently there is no maximum quota system in place at ECE-EP. Any students who meet the criteria for passing will be passed. However, the total number of students who continue to progress toward their ultimate doctoral degree goals is dependent on the available research opportunities.

How many times can I take the Graduate Screening Exam?

You can only take the ECE-EP Graduate Screening Exam once, and the Graduate Screening Exam process must be completed within three semesters of your PhD admission date. However, please note that, since you are given considerable latitude on your Graduate Screening Exam course selection, and when to take them, effectively you are given multiple chances to do well on your Graduate Screening Exam.

What happens once I *summarily pass* the Graduate Screening Exam?

You will receive an official letter within three months of the completion of your Graduate Screening Exam. Your advisor will also be notified of your completion, through a copy of the letter. You may also be directed as to the time to contact the department for discussion of the next steps of your program. This discussion includes your timeline for taking your PhD qualifying exam and your proposed program of study.

What happens if my Core Courses' GPA is between 3.300 and 3.700, and I meet all the other Screening Exam requirements?

If, at the end of your initial three months period, your core courses' GPA is between 3.300 and 3.700 you will not *summarily pass* the screening exam. In this less desirable situation your progress will require detail examination by the entire ECE-EP faculty, at a faculty meeting, with your PhD advisor present. In this meeting your academic progress will be reviewed, discussed, and a vote conducted to decide if you have passed or failed the Screening Exam. All this is avoided if your GPA in the core courses is equal or higher than 3.700.

What happens if I *summarily fail* the Graduate Screening Exam?

You can no longer progress towards the PhD and you will receive an official letter to this effect within three months of the completion of your Graduate Screening Exam. Your PhD advisor, if you have one, will also be notified of your status. You will also be directed to meet with a student services advisor regarding a possible terminal Master's degree.

After I take the ECE-Systems Graduate Screening Exam and fail, can I apply to and take the ECE-EP Graduate Screening Exam?

No, once you initiate the Graduate Screening Exam process in ECE-S, it must be completed in ECE-S. The same is true in the reverse case.

If I am a MSEE student, can I get into the PhD program by successfully completing the Screening Exam requirements?

If admitted into the MSEE program, a student may apply for admission into the PhD program based on performance on the Screening Exam requirements. However, successful completion of the Screening Exam requirements alone does not guarantee admission to the PhD program. Please see the current Chair of the ECE-EP PhD Affairs committee, a student services advisor, or your academic advisor, to discuss the available alternatives for your particular situation.

What is the purpose of the ECE-EP PhD Affairs committee?

The ECE-EP PhD Affairs committee is appointed annually by the ECE-EP Department Chair. Its purpose is to assist the ECE-EP Department with graduate student matters, administer the ECE-EP Screening Exam, monitor the progress of all PhD students, assist with PhD student admissions, and also make decisions on specific cases not explicitly covered by this handbook. For specific information on the current members of the Screening Exam committee please contact the ECE-EP main office, located on EEB 100.

What are my resources if I have any questions or need any clarifications about the Graduate Screening Exam?

You have several resources along the way. To exercise them you can directly contact the Chair or a member of the ECE-EP PhD Affairs committee, a student services advisor, your faculty advisor, or another faculty member for further advice or information.

Section IV - Current ECE-EP Faculty and their Corresponding Areas of Interest

Below is a list of current ECE-EP faculty and their areas of interest. For further information regarding their research, please review the department research booklet and visit its website at <http://ee.usc.edu>. You can also arrange to meet with a faculty advisor. ECE Department Faculty office hours are provided on:

<https://ee.usc.edu/officehours/#:~:text=Tuesdays%20and%20Thursdays%20from%2011,clock%2C%20and%20by%20appointment.&text=M%3A%2010%2D11%3A30pm,I'm%20free%20to%20talk..>

Primary ECE-EP Appointment**Research Area**

Mike Chen	Integrated circuits
Stephen Cronin	Nano optics and Nanoelectronics
Hossein Hashemi	Electronic and Photonic Integrated Circuits
Chia Wei (Wade) Hsu	Photonics, Imaging, and Computational Electromagnetics
Rehan Kapadia	Nanoelectronics, Photonics, and AI/ML Hardware
Mercedeh Khajavikhan	Photonics
Yasser Khan	Bioelectronics, Sensors, and Flexible Electronics
Eun Sok Kim	Micro-electro-mechanical systems (MEMS)
Gianluca Lazzi	Bioelectronics and Applied Electromagnetics
Anthony Levi	Quantum Electronics
Mahta Moghaddam	Applied Electromagnetics
Michelle Povinelli	Photonics and Applied Electromagnetics
Aluizio Prata	Applied Electromagnetics
Armand Tanguay	Photonics
Han Wang	Nanoelectronics and AI/ML Hardware
Wei Wu	Nanoelectronics, Photonics, and AI/ML Hardware
Joshua Yang	Nanoelectronics and AI/ML Hardware
Mengjie Yu	Photonics
Quntao Zhuang	Quantum Sensing and Communication
Chongwu Zhou	Nanotechnology

Associated with ECE-EP**Research Area**

Andrea Armani	Photonics and Biophotonics
Zaijun Chen	Photonics
Jonathan Habif	Quantum Sensing and Communication
Essam Heggy	Applied Electromagnetics
Grace Lu	Nanotechnology
Ellis Meng	Biomedical Microelectromechanical Systems
Anupam Madhukar	Quantum Photonics

Jayakanth Ravichandran
Constantine Sideris

Photonics and Nanoelectronics
Integrated Circuits, Computational electromagnetics, and
Photonics

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