

Guidance to Faculty Preparing Problems for the Ph.D. Qualifying Exam

The Ph.D. Qualifying Exam is a written and oral exam that students admitted to our Ph.D. program take during the second semester of enrollment. The written portion of the exam is intended to assess the student's undergraduate training in the areas of electrical engineering most directly relevant to the proposed area of research. The oral portion of the exam assesses the student's understanding after reading an assigned research journal article and summarizing its relevance and importance.

In the event of a failed first attempt, the student may take the Ph.D. Qualifying Exam a second time at the next exam opportunity. A student who does not pass the Qualifying Exam at an acceptable level in two attempts cannot continue in the Ph.D. program. A student in this situation may petition the ECE Graduate Student Progress Committee to be allowed to transfer into the M.S. or the M.Eng. degree program.

The written exam is ordinarily offered at the end of the third week of classes, or at a later time determined by the ECE Graduate Student Progress Committee. The student will pick up the exam at noon on Friday, and turn the results in by noon the following Monday.

Written Qualifying Exam

The new written qualifying exam is to have two questions that each cover EE topics "tailored to the student's intended research area." Because the exam is in take-home format, it is expected that the student has access to internet search as well as open-book documents and notes. Therefore, the two written questions need to be created to assess the student's problem-solving ability, not merely memorization of facts.

The initial selection of exam areas is:

- Electronic Circuits and Systems
- Control Systems
- Computer Engineering
- Digital Signal Processing
- Optical Systems
- Communication Systems
- Microfabrication/MEMS
- Power and Energy Systems
- Electro-Biological Systems

More than one student may be taking the exam in a particular area, but in any given offering, it is unlikely that questions are needed in all areas.

Faculty in the required area(s) will be assigned by the department head to develop the two written exam questions, and to grade the completed exam(s). One of the faculty in the area will be designated the lead exam writer.

Appropriate exam problems should include both analytical and practical aspects, based upon mathematical knowledge and engineering/science topics known by undergraduate students who have completed the 300-level required courses in the MSU EE/CpE curriculum, and relevant 400-level electives.

Exam problems may have multiple sub-parts, but it is advisable to avoid designing a lengthy problem that will have meaningless results if a careless error is made early in the solution. The goal is to have problems that verify the student has adequate formal engineering preparation to engage in their specific area of research.

The student will pick up the exam at noon on Friday, and turn the results in by noon the following Monday (72 hours total). Therefore, the faculty preparing each exam problem should aim for a solution that, assuming the student is well prepared, requires perhaps 3 hours of effort (~6 hours for the two problems). Problems can require a reasonable expectation that the student will have time to locate and utilize basic reference material, such as common mathematical formulae and contemporary undergraduate EE textbooks.

If questions arise during the exam period, the student shall only consult with the lead exam writer for clarification. No other consultation is allowed. The faculty will need to identify the appropriate manner for contacting them with questions that arise during the exam period. Especially if more than one student will be taking the written qualifying exam in a particular area, the students will be reminded that the exam is to be completed individually, with no collaboration. In the case of multiple students taking the exam in one topic area, it is advisable that each student's exam questions not be identical, but still be of a similar level of difficulty.

Upon completion, the written exam questions are to be graded, with the lead exam writer's discretion on partial credit, using a 100 point scale for each problem (200 points total). The exam score is reported to the ECE Graduate Student Progress Committee. The graded exam is NOT returned to the student.

Oral Qualifying Exam

This is a 1-hour oral exam with 3 faculty members and the student. One week prior to the oral exam, the exam committee will assign the student a relevant research journal article to read and understand. In addition to studying the assigned article, the student will also identify one related journal article for greater depth in the area of the assigned article.

For the oral exam itself, the student gives a 10-minute scholarly presentation about the research paper assigned by the faculty and the related paper the student chose. Following the brief presentation of the papers and the significant methods and results, the faculty members will explore the student's understanding of the material, how the ideas flow in the papers, how the papers relate to each other, and the student's understanding and ability to communicate clearly the fundamental principles of the research area.

The date of the Oral Qualifying Exam is selected by mutual convenience of the student and the exam committee. Ordinarily the Oral Exam should be within a few weeks of the Written Exam, but in any case, the Oral Exam needs to be completed by the end of the 12th week of the semester.

Upon completion, the student's performance on the Oral Qualifying Exam is judged by consensus of the exam committee (a standard grading rubric is being developed). The Oral Exam result is reported to the ECE Graduate Student Progress Committee.

Assessment

Upon completion of the written and oral portions of the exam, the administering faculty committees report the results of the exam to the ECE Graduate Student Progress Committee. The Graduate Student Progress Committee will consider the results of the exam and formulate a recommendation to the ECE faculty. The ECE faculty will in turn review the recommendations of the committee and determine the outcome of the exam (pass or fail). This result will be reported to the student at the conclusion of this review process (which can take 2–3 weeks). Note that the student will only receive an overall pass/fail result, and will not be given scores or feedback on individual parts of the exam.

Relevant sections from the ECE Graduate Handbook

2.4.1 Ph.D. Qualifying examination

The Ph.D. Qualifying Exam is a written and oral exam taken in their second semester by students admitted for PhD studies. A student may retake the exam a 2nd time in the event of a failed first attempt.

2.4.1.1 Written qualifying exam

This is a 72-hour take-home exam with 2 questions covering basic concepts of math and electrical engineering tailored to the student's intended research area (e.g., biosystems, computer engineering, signal processing, controls, power, and optics). The purpose is to assess the student's undergraduate training in those areas most directly relevant to their proposed research area.

2.4.1.2 Oral qualifying exam

This is a 1-hour oral exam with 3 faculty members and the student. The student gives a 10-minute oral presentation about one research paper assigned by the faculty 1 week before the oral exam and one related paper the student finds. Following the brief presentation of the papers, their related methods and results, the faculty members will explore the student's understanding of the material, how the ideas flow in the papers, how the papers relate to each other, and the student's understanding and ability to clearly communicate the fundamental principles of the research area.

A student who does not pass the exam the first time will be offered a second opportunity to take the exam the next time it is offered. A student who does not pass the Qualifying Exam at an acceptable level in two attempts cannot continue in the Ph.D. program. A student in this situation may petition the ECE Graduate Student Progress Committee to be allowed to transfer into the M.S. or the M.Eng. degree program.