

Department of Electrical and Computer Engineering

Ph.D. Qualifying Examination – 2008-2009 Guide

General Background Information:

The Ph.D. Qualifying Examination in the ECE Department consists of a written examination in the students' major area. This examination must be taken by all predoctoral students with a Master's degree or equivalent in the spring Semester of the first year. Students will be tested on graduate course material as specified by the faculty in the chosen area. A student who fails the written examination will be permitted to retake the examination only once in the next academic year.

The purpose of the Qualifying Exam is to determine whether a student is ready to begin the Ph.D. thesis research. The preparation for this exam gives a student the opportunity to integrate studies completed during graduate school into the general research discipline of a proposed research area.

The student's grasp of material covered in core curriculum and other courses is examined. The exam emphasizes not only understanding of the basic ideas and concepts presented in the courses but also the ability to draw together and synthesize material from different courses, readings, seminars, etc.

The student's ability to approach a new problem in ways appropriate for an independent scientist is a central focus of the exam. This ability is certainly difficult to test but is central to the notion that passing the general exams qualifies one to prepare the Ph.D. dissertation/thesis.

Passing/Failing the Qualifying Exam

After completion of the Oral and Written Exams, the Qualifying Examination Committee will immediately meet to determine the outcome. Possible outcomes of these portions of the exam are (1) a pass, (2) a pass with certain conditions requiring further study, (3) a fail. The research adviser of the student is permitted to participate in all discussions about the exam and the student, but does not have a vote in whether the student passes or fails.

Students are reminded of the Graduate School of Engineering Code of Student Conduct as listed in the catalog. The Graduate School of Engineering will initiate immediate disciplinary action in all cases where a student has failed to adhere to Northeastern University rules and regulations for proper student conduct. Among others, cheating, fabrication, facilitating academic dishonesty, and plagiarism are considered violations which may result in immediate dismissal from the Graduate School. Students should refer to the University's Graduate Student Handbook for additional information.

Power Systems

Exam Coordinator: Professor Alex Stankovic (astankov@ece.neu.edu)

There are two portions of the Qualifying Exam: a written examination in the form of a research report and an oral examination. The oral examination will include both a research and course work component.

Requirements to take the exam in the power concentration:

The student must have:

A research adviser

A tentative research thesis topic/field

Application Procedure

In mid-January students should register for the exam using the registration form available on the website.

a. A cover letter should accompany the registration form. This cover letter should clearly indicate the proposed concentration area of the Ph.D. thesis topic. A faculty advisor to the student's research must be specified. Both the advisor and student are required to sign the letter.

b. A brief description of the proposed area of research for the dissertation. This description should be no longer than two pages and should be written by the student and approved by the student's dissertation advisor.

Within 10 days from the submission of the application material, the Qualifying Examination Committee will meet and review the material submitted. If deemed acceptable, the Committee will determine a research project for the student to perform for the written part of the examination. This topic will be decided by the Committee, guided by input from the student's research advisor. Students are encouraged to actively perform research with an advisor prior to spring semester so that the research project can be consistent (although possibly not identical) with the student's current research project with a faculty member.

Within 10 days from the submission of the application material, the Qualifying Examination Committee will meet and review the material submitted. If deemed acceptable, the Committee will determine a research project for the student to perform for the written part of the examination. This topic will be decided by the Committee, guided by input from the student's research advisor. Students are encouraged to actively perform research with an advisor prior to spring semester so that the research project can be

consistent (although possibly not identical) with the student's current research project with a faculty member.

Written Exam

At the end of the spring semester the student must submit the written exam, which is given by a final report of the research project assigned. The report should clearly indicate the research carried out. The report gives an opportunity for a student to demonstrate the ability to master an area of interest, to show progress on a reasonable research problem, and to argue for its relevance and tractability. (If the student has encountered difficulties such as intractability or negative results, it should still be possible to tell an interesting story.) If in doubt about the content of the report, the student should consult with the research advisor.

Oral Exam

The oral exam is administered between five and ten days after the research report is handed in, to allow the Committee time to review the performance on the written part. The oral exam gives the students an opportunity to describe their research, to clarify questions raised by the written exam, and to further demonstrate their ability to organize and utilize scientific concepts and information. At the beginning of the oral exam, students will make a short presentation, lasting approximately 20 minutes, describing research they have carried out.

After the presentation, the examining committee will ask questions pertinent to the research as well as other questions.

Passing/Failing the Qualifying Exam

After completion of the Oral and Written Exams, the Qualifying Examination Committee will immediately meet to determine the outcome. Possible outcomes of these portions of the exam are (1) a pass, (2) a pass with certain conditions requiring further study, (3) a fail. The research adviser of the student is permitted to participate in all discussions about the exam and the student, but does not have a vote in whether the student passes or fails.

Electromagnetics, Plasma and Optics

Exam Coordinator: Professor Edwin Marengo (emarengo@ece.neu.edu). Exam to be given Monday, June 15, 2009.

We will give one, three-hour written examination on the fundamental course material for students in the Electromagnetics area.

Specifically, the students must solve four problems out of the following nine:

Six problems related to Electromagnetics

ECE G341 Electromagnetic Theory 1

ECE G202 Electromagnetic Theory 2

The students must solve three problems out of the given six.

Three problems related to the general electrical engineering background:

One problem related to ECE G203 Mathematical Methods in Electrical Engineering II

One problem related to ECE G204 Applied Probability and Stochastic Processes

One problem related to Linear Systems (Undergraduate course at Northeastern ECEU464) or an equivalent undergraduate class.)

The students must solve one problem out of the given three.

Please note that it is a closed book exam with only a basic calculator allowed. No questions are allowed during the exam.

**Microsystems, Materials, and Devices
(formerly Circuits, Devices and Microfabrication)**

Exam Coordinator: Professor Nick McGruer

The exam will have two parts. In the first part, students will provide written answers to three questions on topics in the area of Microsystems, Materials, and Devices, with at least one of the questions in the student's area of research interest. In the second part, the student will be examined orally by a committee of professors on the same questions. Students will have approximately two-three weeks to prepare answers. After the written answers are submitted, the oral exam will be scheduled. For reference, the core coursework representative of the range of knowledge expected of a Ph.D. student in this area is given below, along with an incomplete list of other courses that may be important to particular students.

Core knowledge:

ECEG240 Analog Integrated Circuit Designs

ECEG201 Solid State Devices

ECEG353 VLSI Design

ECEG243 Integrated Circuit Fabrication

Undergraduate electromagnetic, linear algebra, and differential equations

Supplementary courses:

ECEG242 Integrated Circuits for Communications and Analog Signal Processing

ECEG105 Optics for Engineers

ECEG244 Introduction to Microelectromechanical Systems (MEMS)

Computer Engineering

Exam Coordinator: Professor Yong-Bin Kim (ybk@ece.neu.edu)

The written portion of the Qualifying Exam in CE will be given in March and you will have two weeks to complete the exam.

The oral portion of the exam will follow.

The exam will consist of one question submitted by each Computer Engineering faculty member. The questions will be open-ended and answering them may require background research. Students have two weeks to select and answer two questions in writing, and they may use any reference materials that are useful to them. Please pick up exams and deliver completed exams to Faith Crisley, 405 Dana Hall. You may also email in PDF format by the date to be announced in mid-January 2009.

For each question, a group of three Computer Engineering faculty members will be assigned to examine all students who answer that question. The group should include the faculty member who submitted the question and may include an examined student's adviser.

The group of faculty members will use each student's written response as a starting point for further questioning. Questions will judge the quality and depth of a student's understanding of the relevant material. The group will collectively assign a grade of "pass", "marginal", or "fail" for each student's responses to each question, but the written response will not be separately graded.

After the oral examinations have been completed, all the Computer Engineering faculty will discuss each student's performance. The Computer Engineering faculty will assign an overall grade of "pass", "conditional pass", or "fail" to each student. These grades will be based on the grades assigned for the two questions and on comments from the examining faculty. The conditional pass will be determined by the exam committee and will be based on the oral examination evaluation.

Communications, Control and Signal Processing

Exam Coordinator: Professor Hanoch Lev-Ari
levari@ece.neu.edu

The qualifying exam is a research-based exam consisting of two parts:

- (1) A written report, and
- (2) An oral exam

The Committee will design a set of 7 to 9 research-oriented, open-ended problems. This set of problems will be available to students March 2, 2009 from Faith Crisley in 405 Dana Hall, and is due back to Faith on Wednesday, March 11, 2009.

Each student will chose **ONE** problem from this set, and write a report that satisfies the requirements included in the problem description. This report has to be submitted in person by the March 11, 4:30 p.m. deadline.

The oral exam will be conducted by a committee of 3 faculty members, and it will consist of:

- A 10-minute presentation by the student on the written problem and his/her solutions.
- Examination of his/her background in the general area of the problem.
- Examination of the written report and the solution discussed in that report, and
- Probing of any questions and/or issues raised during the presentation.

The oral examination will occur after March 11th.

The final results will be made available on or before April 3, 2009.

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