

8. Ph.D. Preliminary Examination

The purpose of the preliminary examination is to identify those students who are qualified to work towards the Ph.D. degree in electrical and computer engineering. This exam shall test basic competency across a broad range of relevant topics. The preliminary examination is given at the beginning of the Fall and (or) Spring semesters. A student must take this exam within one calendar year plus one semester after being admitted into the Graduate program. A student must register to take this exam with the Electrical and Computer Engineering Department's Director of Graduate Studies Office at least two weeks prior to the exam.

The preliminary examination is of eight hours duration. It consists of problems that are categorized into the following five areas, in which relevant topics are identified.

- **COMPUTERS:** digital logic, combinational and sequential; elementary computer architecture; computer design; state machines; concepts in computer programming; data structures and languages; data acquisition and display: A/D, D/A, GP/B interfaces; microprocessor controller design.
- **ELECTRONICS:** analog and digital circuit analysis and design; VLSI design; IC technology and fabrication; physical and quantum electronics; power electronics; device and circuit models.
- **SIGNALS & SYSTEMS:** continuous and discrete linear systems and signals; steady state and transient response; Laplace, Fourier and z-transforms; Fourier series; sampling; transfer function; control systems; state variable representation.
- **SCIENCE:** computer science, mathematics, and physics.
- **COLLATERAL AND SUPPORTING AREAS:** electromagnetics, power, etc.

Each examinee must select and work exactly eight problems from at least three areas from the problem set. At most, four problems can be answered from any one area. Each problem's level of difficulty is such that a student having the anticipated knowledge should be able to provide a satisfactory answer in thirty (30) minutes. The level of problem difficulty is at or below that of beginning graduate courses, where a beginning graduate course is one having no graduate level prerequisite. The problems are developed based on a set of topics with an associated reading list that may be obtained from the DGS Office in advance of the scheduled exam. The preliminary examination is open book and the use of a pocket calculator is permitted.

The results of the preliminary examination are to be transmitted to the department's DGS Office, who will notify each examinee of his or her pass/fail result.

Upon recommendation of the student's academic advisor and the approval of the DGS Office, a student who has failed the preliminary examination once may be permitted to retake the examination the next time it is offered. A recommendation for a second examination must be submitted to the DGS within four weeks following the first examination. If a student receives a passing grade on the second attempt, all references to the first examination result will be removed from the student's record.

An oral examination will be offered to students who have failed the Ph.D. written examination two times. The examination will be delivered by a panel of four faculty. Three representatives will be chosen by the faculty, each expert in one of the three subject areas chosen by the student on his or her written exam. One "departmental representative" (either the Department Chair, the Chair of the Department Ph.D. Exam Committee, or the DGS) will be chosen by the student, and will serve as Chair of the Oral Exam Panel for this student. The student's advisor may not serve on this panel. The examination will be closed to non-participants.

The oral examination will determine the student's basic understanding of the three areas of undergraduate electrical and/or computer engineering chosen on his or her Ph.D. written examination, or related areas. The topics covered in the examination will focus directly on areas of inadequate performance on the written Ph.D. examination. The student can meet with his panel members separately or collectively to discuss bounds of typical topics from these areas.

The examination will be scheduled at a time mutually convenient for the faculty panel and the student, but no later than the first week of the next Fall semester classes. The examination will be scheduled at least 2 weeks in advance.

At the close of the examination, the panel will determine whether the student has sufficient knowledge of basic electrical and computer engineering topics to provide basis for doctoral study in electrical and computer engineering. If consensus cannot be reached, a vote will be taken. At least 3 votes in favor of passing the student are required for the committee to make a recommendation to the general faculty.

Given a favorable vote, the panel chair will report to the general faculty the results of the examination. A positive recommendation will include a description of specific knowledge or competence demonstrated by the student which would warrant the overturning, by the general faculty, of the written examination failure. A majority vote of the general faculty will signify passing of Ph.D. examination requirements in partial fulfillment of the degree requirements.

Given an unfavorable vote, a recommendation for graduate program termination will be submitted to the Graduate School. This recommendation will normally take place in the semester in which the vote occurs. A student who fails to take the preliminary examination or the re-examination in the prescribed time frame shall be considered to have taken and failed the examination or re-examination.

SUGGESTED BOOKS FOR PREPARATION OF
EE PRELIMINARY EXAMINATION
(Revised January 21, 2002)

Computer Engineering

Clements, Microprocessors System Design, 3rd Ed. or later or similar text;
Roth, Fundamentals of Digital Design, or similar text in digital logic design;
Wakerly, Digital Design Principles and Practices or similar text in digital logic.

Computer Science

Aho, Hopcroft & Ullman, Data Structures and Algorithms or similar text;
Horowitz, Fundamentals of Programming Languages or similar text in
languages/data structures;
Patterson and Hennessy, Computer Organization and Design or similar text on
computer architecture.

Signals and Systems

Soliman and Srinath, Continuous and Discrete Signal and Systems;
Dorf & Bishop, Modern Control Systems, 9th Edition, 2001;
Phillips & Harbor, Feedback Control Systems, 4th Edition, Prentice Hall, 2000;
E.W. Kamen and B.S. Heck, Fundamentals of Signals and Systems Using Matlab
Prentice Hall.

Mathematics

Any calculus book;
Kreyszig, Advanced Engineering Mathematics, Pub. Wiley.

Electronics

Streetman, B. G. Solid State Electronic Devices;
Gray and Meyer, Analysis and Design of Analog Integrated Circuits;
Pierret, Semiconductor Device Fundamentals, 1996, Addison-Wesley;
Jaeger, Introduction to Microelectronics Fabrication;
Hodges & Jackson, Analysis and Design of Digital Integrated Circuits,
McGraw-Hill.

Fields, Waves, and Quanta

Cheng, David K. Field and Wave Electromagnetics, 2nd Edition.

General

Stephenson, Power Systems Analysis;
Dewan and Straughen, Power Semiconductor Circuits;
Dewan and Straughen, Electrical Machinery;
Sadiku, Elements of Electromagnetics, Oxford University Press, 1995.