

## Qualifying Examination for Admission to the Ph.D. Program in Systems and Entrepreneurial Engineering

Students may apply for admission to the Ph.D. program in Systems and Entrepreneurial Engineering (SEE) upon receiving a B.S. degree or an M.S. degree in an engineering or related discipline. A master's thesis is required of all students pursuing the Ph.D. degree. In general, students entering the program with a B.S. degree should take the Qualifying Examination (the Qual) before obtaining the M.S. degree. Thus, students entering the Ph.D. program with a B.S. degree are encouraged to take their qualifying examinations during their fourth semester, and no later than the fifth semester after beginning their graduate study. Students entering the Ph.D. program with a M.S. degree must take their qualifying examinations no later than in their third semester of enrollment.

The Ph.D. degree requirements in Systems and Entrepreneurial Engineering are structured to assure depth in the student's area of research, and at the same time, to assure breadth in engineering. Admission to Ph.D. candidacy is based on the faculty's evaluation of the student's research potential, scholastic competence as evidenced by grades, and satisfactory performance on the Qual.

To be permitted to take the Qual all students must satisfy the following minimum requirements:

1. A signed MS/PhD Advisor Agreement Form must be on file in the IESE Department office.
2. 12 SH of 500-level graded coursework must be completed in IESE courses other than thesis credit (GE 599).
3. A grade point average of at least 3.25 must have been attained on all graduate coursework completed and also on all 500-level coursework completed.

The Qual will have two parts. For the first part (to demonstrate sufficient breadth of knowledge), students are required to select three of five different areas listed in Column A (attached). Each student must select at least one area marked by a ★, reflecting the business-side of engineering, and at least one area with no ★. The examination for the three selected areas in Column A will be a written examination intended to allow the student to show sufficient depth of understanding and adequate overall breadth of background. That is, the purpose of the written exam is to determine sufficient knowledge in core areas of the SEE program and to evaluate the candidate's ability to think conceptually in the selected area at and beyond the standard undergraduate level. (*Students must attain a minimum score of 70% in each area of the written examination to pass.*)

For the second part of the Qual, students will undergo an oral examination in one area from the list in Column B. The oral examination is intended to show sufficient depth of understanding of an area related to each student's research. The student will be asked to select in advance

two subjects from Column B (related to his/her interest and research). The Qual Committee will then select one of these two areas, and assign the student one or two journal papers to read and then critically appraise (in terms of its overall significance, its influence on the development of the field, possible future research directions in the area of the paper and connections to the student's research interests) during the oral exam. To avoid conflict of interest, no papers authored or co-authored by departmental faculty will be assigned for the oral examination. The presentation should cover 25 minutes, leaving 35 minutes for questions. Questioning may range beyond the material in the assigned paper and may include questions relating to the student's written examination problems.

Students should not expect to defend their research in the Qual. Rather, the examination will evaluate their understanding of a field closely related to their research. (Candidates' research topics and results will be examined independently when the student is ready to take the Preliminary Examination in front of his/her Thesis Committee.)

The Graduate Committee will oversee preparation of the written portion of the Qual, and administer and evaluate both the oral and written portions of the Qual. The Graduate Committee will consist of a minimum of 6 members, whose research and teaching cover the topics in Column A.

The decision to pass or fail a student will be made on the basis of the student attaining the minimum requirement of 70% in each area of the written examination, performance on the oral exam, grades in formal courses, and recommendation by the Thesis advisor. A student who fails any portion of the Qual may repeat that portion of the exam in the subsequent semester. If desired, the student may choose to take the written exam in a different area to make up a failed portion of the written exam, however, this option will be considered the second exam attempt. A student who fails the exam on the second attempt will not be allowed to continue in the PhD program.

<u>Column A</u>	<u>Relevant Courses</u>
★ Product Design and Management	GE 161, GE 498-AY1, GE 498-AA, GE 498-XX
★ Reliability and Quality Engineering	IE 430, IE 435/GE 411, GE 498-HK
Control	GE 320, GE 424
Mechanics and Design	GE 311, GE 410
Operations Rsch. & Eng. Stats	GE 330/IE 310, GE 331/IE 300

In Column A, students will be tested for proficiency in the material covered in IESE curricula. Courses from the GE and IE curricula are listed that could serve as a guideline for the material to be tested under this Column (choose 3, at least one from ★).

<u>Column B</u>
Bioengineering
Convex Optimization
Data Mining
Decision Making Theory
Control and Dynamic Systems
Financial Engineering
Stochastic and Genetic Algorithms
Mechatronics
Nondestructive Evaluation
Nonlinear programming
Nonlinear systems analysis
Product Development
Project Management
Quality Engineering
Reliability Engineering
Structural Optimization
Robotics
Solid Modeling
System Identification
Others

Areas listed in Column B are not exhaustive, and the Graduate Committee will consider additional suggestions by professors and students. It is expected that areas listed under Column B are at the graduate level, as the oral examination is intended to be related to the student's research interests (choose two).