

GUIDE FOR DOCTORAL STUDENTS

Biological Systems Engineering

University of California, Davis

GENERAL INFORMATION

1. Departmental

The Graduate Program in Biological Systems Engineering is based in the department of Biological and Agricultural Engineering. Graduate students share many of the privileges and responsibilities as regular departmental staff members, and are encouraged to participate in staff meetings, seminars, and departmental social functions.

Office and furniture (desk, chair, and file) are provided as long as space is available. Doctoral students generally have first priority for office space. At times, space limitations may allow desk assignments only to graduate students employed as teaching or research assistants or equivalent. Desk space for students who are not employed will be assigned on the basis of seniority. A key is issued that provides access to all research laboratory areas; access to the mechanical shop is available to graduate students who have special needs and are qualified to use the equipment. Students must meet training requirements before using shop and laboratory facilities. Each student is assigned a mailbox, which should be checked daily.

The technical services of shop and laboratory personnel are available to assist with the construction of any equipment and/or with the analysis required for dissertation research. The **mechanical shop** provides assistance for the construction or fabrication of physical equipment. The **electrical shop** offers comparable service for electrical and electronic devices. The **chemical laboratory** is available to assist in setting up or performing chemical analyses. **Computer facilities** are available in 1336 and 3026 Bainer Hall as well as at other locations.

2. Graduate Studies Procedures

The UC Davis catalog, College of Engineering publications and the quarterly class schedule contain most of the information needed regarding graduate requirements, courses offered, registration, etc. Special note should be taken of the calendar for deadlines that graduate students must meet.

The Biological Systems Engineering program is a departmentally based graduate program based in the department of Biological and Agricultural Engineering. Each field of study offered at the University of California is permitted to refine the general University rules to meet its specific objectives. General rules for graduate programs in the College of Engineering are outlined in the College of Engineering Bulletin.

3. Advisers

a. Admissions Adviser

The Admissions Adviser of the Biological Systems Engineering program is responsible for all admissions-related details, such as correspondence with prospective graduate students and review of applications for admission.

b. Graduate Adviser

The Graduate Adviser of the Biological Systems Engineering program is responsible for all graduate program details, such as assistance with preparation of study lists and approval of any Graduate Studies forms requiring the signature of a "Graduate Adviser".

c. Major Professor

The Major Professor is the faculty member who will assist in preparing a detailed study program, in conducting the research that precedes the preparation of the dissertation, and will chair the dissertation committee.

4. Faculty Committees

The chair of each of the committees listed below must be a member of the Biological Systems Engineering Graduate Program. Additional committee members must belong to the Biological Systems Engineering Graduate Program unless noted below.

a. Guidance Committee

This committee of three consists of the Major Professor plus two additional members suggested by the student in consultation with the Major Professor and the Graduate Adviser. The principal function of this committee, selected at the beginning of the first quarter of residency, is to assist the student in planning a program of study. Up to two committee members may be from other graduate groups or graduate programs in the College of Engineering. One member may be from a graduate group or graduate program outside the College of Engineering.

b. Qualifying Examination Committee

This committee of **five** is chosen to administer an examination after the formal course work is completed. The membership of this committee is suggested by the student and the Major Professor to the Graduate Adviser, who in turn solicits approval from the Office of Graduate Studies. At least one committee member must be (and a maximum of two may be) from outside the Biological Systems Engineering Graduate Program. The faculty member who will serve as chair of the dissertation committee may not serve on the qualifying examination committee.

c. Dissertation Committee

This committee of **three** is chosen by the student in consultation with the Major Professor, and is recommended by the Graduate Adviser who solicits approval from the office of Graduate Studies. This committee assists the student in planning the research program, offers advice during the course of the research, administers a public presentation of the study, and helps in the preparation of a suitable manuscript. The major professor serves as chair of this committee. Up to two committee members may be from other graduate groups or graduate programs in the College of Engineering. One member may be from a graduate group or graduate program outside the College of Engineering.

DOCTORAL DEGREE

1. Significance

The doctoral degree is not granted by the University of California merely for the fulfillment of technical requirements, such as residence, or the completion of fundamental courses. The recipient of a Doctoral degree is understood to possess thorough knowledge of a broad field of learning and to have given evidence of distinguished accomplishment in that field; the degree is a warrant of critical ability and powers of imaginative synthesis. The degree also signifies that the recipient has presented a doctoral dissertation containing an original contribution to knowledge in a chosen field of study.

2. Degrees Offered

Two doctoral degrees are available to graduate students in Biological Systems Engineering. Programs for the Doctor of Philosophy (Ph.D.) emphasize the science or research features of engineering and are intended to provide the student with abilities to assist with furtherance of the fundamental knowledge of

engineering. Doctor of Engineering (D.E.) programs emphasize design, analysis, economics, management, and/or labor, and are intended to assist the student with training useful to the professional engineer.

3. Residence Requirements

Doctoral candidates must be registered for a minimum of six academic quarters after admission to the graduate program. Two consecutive six-week Summer Sessions may be counted as the equivalent of one regular quarter.

4. Normative Time To Degree

A "normative time to degree" has been established for each doctoral program. It is based upon an academic assessment of how long it should take a well-prepared full-time student who works continuously in a graduate program, to complete all requirements. For Engineering, the normative time is five years.

The normative time begins at the time of first registration as a graduate student at the University of California, Davis. All quarters spent at Davis after first registration in any graduate program (including time spent working on a Master's degree) apply toward normative time. Time spent on another campus, unless as an intercampus exchange student, does not count.

5. Requirements for the Doctor of Philosophy Degree

Formal requirements for the degree of Doctor of Philosophy include the satisfactory passing of the qualifying examination, completion of an acceptable dissertation, and a public presentation of the doctoral research. In the qualifying examination, the student is examined on the major and minor fields defined in the student's Program of Study. A high level of learning and proficiency must be demonstrated in the major field and a firm grasp of basic principles and their application in the minor field. Ability to correlate knowledge in these areas is emphasized. Preparation for the qualifying examination is done through a combination of course work and individual study. The Program (please refer to the attached figure) requires that at least 30 units of graduate courses (of which at least 15 units must be in graduate engineering courses), exclusive of seminars and research, and an additional 15 units of upper division or graduate courses be completed before taking the qualifying examination. At least 23 of the required 45 units must be in engineering courses. These figures include suitable courses taken during the Master's Program. At least 24 units of the required total must be taken at Davis. In-depth knowledge usually can be obtained by completing about 30 units in upper division and graduate courses in the major field. Study in a minor field is not expected to be as extensive as in the student's major field; it should, however, encompass the equivalent of 15 units or more in a particular field, typically 2 upper division and 3 graduate courses. In other words, the breadth requirement cannot be met by a student taking a large number of single courses in different areas. Specific names for the major and minor fields are necessary. Students whose academic preparation does not include any coursework in biological/life sciences during their undergraduate studies must take at least one course in life sciences. Moreover, students should demonstrate skills in advanced mathematics, and experimental design and analysis. These requirements can be met by taking an advanced engineering mathematics course such as ECH 259 Advanced Engineering Mathematics (preferred), ECH 140 Mathematical Methods in Biochemical and Chemical Engineering, EAD 205A Mathematical Methods, MAT 118B Partial Differential Equations: Eigenfunction Expansions, or MAT 185B Complex Analysis with Applications. The design and analysis of engineering experiments requirements can be satisfied by taking EBS 265 Design and Analysis of Engineering Experiments, PLP 222 Experimental Approaches in Plant Pathology or an

equivalent.¹ In addition to the 45 units of courses required as preparation for the qualifying examination, all students in the program are required to take EBS 200 Research Methods in Biological Systems Engineering.

The doctoral dissertation must be an original and substantial contribution to knowledge in the student's major field. It must demonstrate the student's ability to carry out a program of advanced research and to report the results in accordance with standards observed in recognized scientific journals. A public presentation of the dissertation research is required prior to the dissertation being signed.

6. Requirements for the Doctor of Engineering Degree

The formal requirements for the degree of Doctor of Engineering are the satisfactory passing of the qualifying examination, completion of an acceptable dissertation, and a public presentation of the dissertation.

The Doctor of Engineering program is fully equivalent academically to the Ph.D. program but emphasizes the professional aspects of engineering rather than research. The student prepares for a qualifying examination in a major field of study and one **or** two minor fields. The major field area may include a wider range of subject matter than is customary in the Ph.D. program. As a consequence, the Doctor of Engineering candidate is not expected to probe into a single field of learning as deeply as the Ph.D. candidate. Minor fields should include courses outside engineering. Examples of minor fields are bioscience, business management, economics, international agricultural development, law, sociology, statistics, mathematics, political science, psychology and operations research. The area covered by the qualifying examination is thus broadened, and the minimum course work required to prepare a student for the examination may exceed the 30 graduate units and 15 upper division or graduate units suggested for the Ph.D. candidate. The program for the major field should be composed of at least 30 units of courses that are related to the definition and solution of problems in a recognized engineering area. This group can include courses in physical sciences, engineering sciences, statistics, and mathematics, and is expected to encompass knowledge essential to high-level professional engineering performance. The program for the minor field should include at least 15 units and form a coherent body of knowledge that complements the student's major. In addition to the 45 units of courses required as preparation for the qualifying examination, all students in the program are required to take EBS 200 "Research Methods in Biological Systems Engineering."

The Doctor of Engineering dissertation is based on creative analysis or design rather than research. Research may be required to carry out the project, but the principal criteria of achievement are originality and creativity relative to the project. Novel and imaginative approaches to the solution of problems must be demonstrated in the dissertation. A public presentation of the dissertation is required prior to the dissertation being signed. The effort required to complete the D.E. program is fully equivalent to that required for the Ph.D.

7. Sequence of Events

Insofar as possible, **doctoral students are expected to manage their own programs.** They are expected to take the initiative in identifying the courses to be used in their academic program, in suggesting members for the various required committees, and in selecting the subject of investigation for their dissertation

a. Guidance Committee Selection

¹ These underlined requirements are applicable to students who are admitted to BSE graduate program starting with Fall 2005

If the doctoral student has not selected a Major Professor prior to arrival at Davis, the Graduate Adviser will help the doctoral student select a Major Professor. The Major Professor will help the student select two additional faculty members to constitute the guidance committee who will assist with the identification of the courses that will constitute the program for the degree.

b. Program of Study Development

The major area of interest should be identified and a very tentative study program outlined before selecting courses for the first quarter. Later during the first year, the doctoral student should pursue the development of the study program in more detail with the guidance committee. Courses included in the study program should be selected to provide a suitable base for dissertation research. Once approved by the Guidance Committee, the program of study must be submitted for approval by the Executive Committee of the Graduate Program **by the end of the first year of residence.**

c. Qualifying Examination

To be eligible for examination, the doctoral student must have satisfied all Graduate Program course work requirements, have removed all deficiencies, and must have at least a 3.25 average in all work undertaken in graduate standing. **The doctoral student must be registered in the quarter in which the Qualifying Examination is taken.**

An Application for Qualifying Examination (available from the Graduate Adviser or Graduate Studies) must be submitted to the Office of Graduate Studies at least eight weeks prior to the examination date. The membership of the examination committee is recommended on the application. When the committee is approved, the Office of Graduate Studies will notify the student, the committee members, the Graduate Adviser, and the Department Chairperson. **THE QUALIFYING EXAMINATION CANNOT BE TAKEN BEFORE RECEIVING THE NOTICE OF APPROVAL.**

The date of the examination will be arranged between the student and the committee chairperson, who will in turn advise the Office of Graduate Studies. The committee will conduct the examination, and will immediately thereafter inform Graduate Studies of the results.

Upon recommendation of the Qualifying Examination Committee and with the approval of the Graduate Council, a student who received a “not pass” on the examination may repeat it once.

d. Advancement to Candidacy

Upon successful completion of the qualifying examination, the doctoral student is sent an application for advancement to candidacy by Graduate Studies. When it is filled out and signed by the Graduate Adviser and Major Professor, the candidacy fee should be paid at the Cashier's Office and the form returned to Graduate Studies. The application must be filed in order for the doctoral student to be officially advanced to candidacy.

e. Dissertation Committee Selection

On the advancement to candidacy form, the doctoral student proposes a dissertation committee of **three**. The student is expected to contact the potential committee members to make sure they will be able to serve. The committee chairperson should determine the wishes of the individual members regarding assistance with the research and dissertation review at the time the dissertation committee is constituted.

f. The Dissertation

Doctoral students are not expected to conduct their dissertation research until after course work is completed and the qualifying examination is passed; however, the process of dissertation topic selection should be initiated much earlier. The student should begin consultations with the

faculty on an individual basis during the first quarter relative to research prospects so that this important part of the program can be planned early.

A dissertation on a subject chosen by the candidate, bearing on the principal subject of study and of such character as to show ability to prosecute independent investigation, must be approved by the dissertation committee before the degree will be recommended.

g. The Public Presentation

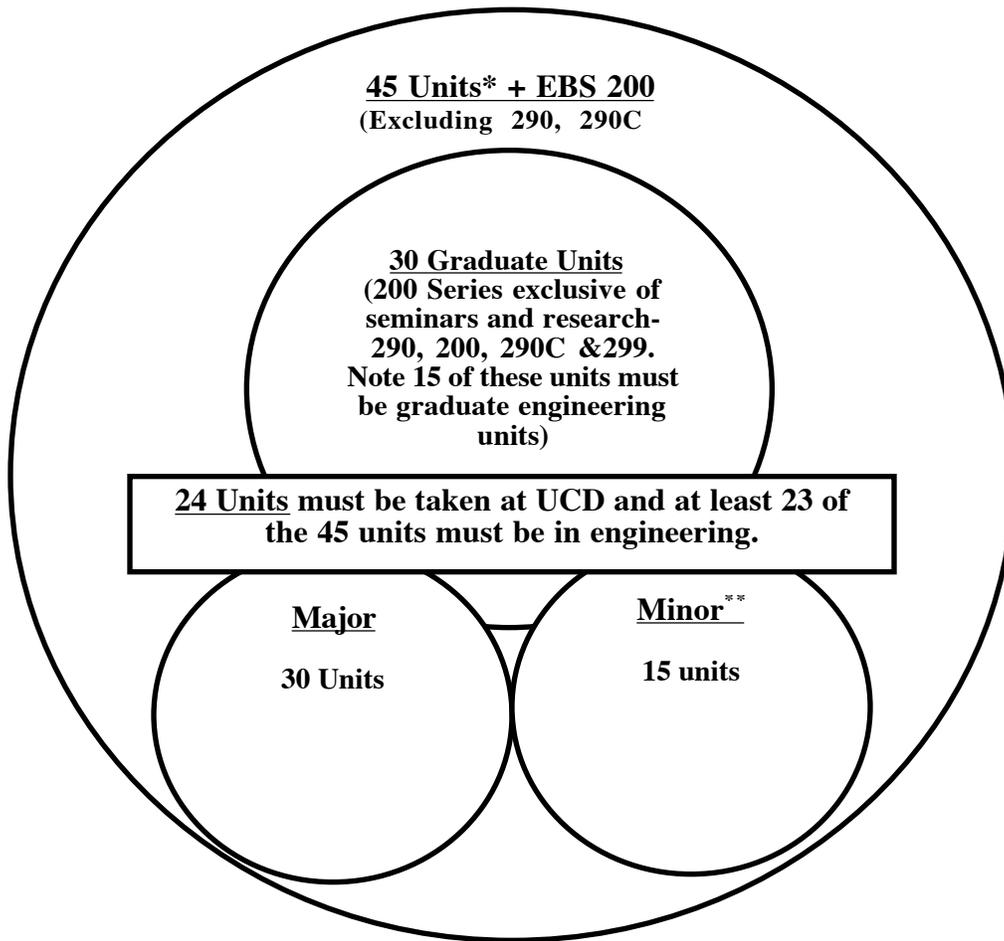
The student submits a draft of the dissertation to the committee. The student obtains a presentation form from the Graduate Adviser, then schedules, in agreement with the committee, a public presentation of the research. Following the presentation the committee meets to review the research. The student completes the final version of the dissertation and obtains the signatures of the committee members.

Degree check list:

- ✓ Select a guidance committee and put together a program of study during your first quarter in residence. **This program of study should be submitted to the Executive Committee for approval during the first year in residence.**
- ✓ Take your qualifying examination as soon as you complete the courses listed on your program of study. Complete the form to schedule your qualifying examination ahead of time. **You can not take the qualifying examination without the approval from the Graduate Studies.**
- ✓ Upon advancement to candidacy [i.e. after passing the qualifying examination], select your dissertation committee.
- ✓ Upon completion of your research submit your rough draft to the dissertation committee and **schedule your public presentation with the approval of the committee members.**
- ✓ Following the public presentation obtain **signatures from the dissertation committee members and submit the signed form to the Graduate Advisor.**
- ✓ Submit the final version of the dissertation to Graduate Studies!

within the limits imposed by law or University policy. In conformance with applicable law and University policy, the University of California is an affirmative action/equal opportunity employer.

Ph.D. Program of Study:



*Students must include a course in advanced mathematics, and another in advanced experimental design and analysis. Those who did not have life sciences background in their undergraduate studies must also take at least one life science course.

**Minor typically consists of three graduate and two undergraduate courses.