

## **II. MASTER'S DEGREES**

Three Master's degrees are available to graduate students in Biological Systems Engineering. Programs for the **Master of Science (Plan I)** 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. For students who want to strengthen their preparation either for job market or for further professional education, we offer **Master Science (Plan II)**. This program is particularly suited to highly qualified students who plan to pursue graduate education with an opportunity to reduce overall time to graduate degree commonly associated with MS Plan I programs. Programs for the **Master of Engineering** emphasize design, analysis, economics, management, and/or labor, and are intended to assist the student with training that is useful to the professional engineer.

### **1. Admission Requirements**

Highly qualified students with or without a BS degree in engineering may apply. However, students with a non-engineering BS degree need to meet additional prerequisites for admission and should make up deficiencies in engineering core and upper division courses as listed in #1a and b below. The application procedure will be as follows:

- Students who want to be considered for fellowships, should apply to the program by the published deadline by completing the standard MS application form (<http://gradstudies.ucdavis.edu/index.cfm>) and paying appropriate fees to be considered for potential fellowships and priority consideration. However, application will be accepted until May 31<sup>st</sup>, if the applicant does not expect to be considered for fellowships administered by UC Davis (i.e., an applicant who is self-supporting or has other sources of support such as home country fellowship, international fellowship, Graduate Assistantship from the program etc.)
- Applicants will have a minimum GPA of 3.0.
- Applicants must take the GRE test.
- All students applying to the program will be required to submit three letters of recommendation.
- International applicants must take the TOFEL test.
- Applicants are strongly encouraged to communicate with potential research advisers (major professors) prior to admission to the program.
- Students admitted to the MS program will be invited to the new student orientation in the Fall quarter, when the graduate adviser will explain all the degree requirements. The student will work with her/his major professor and constitute a course guidance committee during the first quarter in the program to plan the program of study. Students in the MS Plan II program must submit the program of study to the Executive committee for approval by the end of the first academic quarter in residence. Students in other MS

programs (Plan II or MEngr) must submit their program of study to the Executive committee for approval by the end of second academic quarter in residence.

- a) **Prerequisites:** In addition to the admission requirements stated above, applicants with non-engineering BS degree are expected to have passed with letter grades the following UC Davis equivalent science and mathematics courses:
- i. Differential and Integral Calculus (Calculus - MATH 21 A, B & C; Vector Calculus - MATH 21 D; Linear Algebra - MATH 22 A; Differential Equations - MATH 22B).
  - ii. Physics (Classical Physics - PHY 9A & B; Electricity and Magnetism - PHY 9C)
  - iii. Chemistry (General Chemistry - CHE 2A & B)
- b) **Deficiencies:** Non-engineering students must pass with letter grade any missing UC Davis equivalent engineering core and upper division engineering courses listed below during their MS program:
- i. Circuits 1: ENG 17
  - ii. Statics: ENG (35)
  - iii. Circuits: ENG 100
  - iv. Dynamics: ENG 102
  - v. Fluids: ENG 103/EBS 103
  - vi. Mechanics of materials: ENG 104
  - vii. Thermodynamics: ENG 105, and
  - viii. Two additional upper division courses in engineering.

Please visit <http://bae.engineering.ucdavis.edu/graduate/admission-requirements/> for more information.

2. **Master's Plan:** There will be three MS degree options – MS Plan I (Thesis option), MS Plan II (Comprehensive Examination option), M. Engr. (Project option). MS Plan I requires a research based thesis, MS Plan II requires a comprehensive examination, and M.E. requires a design based project, a report, and a comprehensive examination. These plans satisfy the graduate degree requirements as stipulated by the Academic Senate.

[http://academicsenate.ucdavis.edu/cerj/manual/dd\\_regs.cfm#501-](http://academicsenate.ucdavis.edu/cerj/manual/dd_regs.cfm#501-)

**MS Plan I.** This plan requires a minimum of 30 units of graduate and upper division courses (100 and 200 series only) consisting of:

- (i) Research Methods in Biological System Engineering, EBS 200 (2 units)
- (ii) Seminar, EBS 290 (1 unit)
- (iii) 12 units of graduate engineering courses
- (iv) 5 units of graduate or upper division courses not required for EBS BS degree.
- (v) At least 6 units of 290C, 299 Research
- (vi) Other graduate or upper division courses for a total of at least 30 units. For those students who did not take any life sciences classes during their undergraduate program, at least one course from life sciences should be included.

- (vii) Written thesis based on research and public presentation (exit seminar). Thesis should be signed by three thesis committee members.

**MS Plan II.** This plan requires a minimum of 36 units of graduate and upper division courses (100 and 200 series only) consisting of:

- (i) Research Methods in Biological System Engineering, EBS 200 (2 units)
- (ii) Seminar, EBS 290 (1 unit)
- (iii) 12 units of graduate engineering courses
- (iv) Additional 6 units of graduate courses for a total of 18 graduate units including 12 units of engineering courses listed in # (iii) above. The remaining 6 units can be graduate or upper division courses not required for EBS BS degree
- (v) At most 9 units of 290C, 299 Research (up to 9 units)
- (vi) Other graduate or upper division courses for a total of at least 36 units. For those students who did not take any life sciences classes during their undergraduate degree program, at least one course from life sciences should be included.
- (vii) Oral Comprehensive Examination before a three faculty committee members

**M.Engr:** This plan requires a minimum of 36 units of graduate and upper division courses (100 and 200 series only) consisting of:

- (i) Research Methods in Biological System Engineering, EBS 200 (2 units)
- (ii) Seminar, EBS 290 (1 unit)
- (iii) 12 units of graduate engineering courses
- (iv) Additional 6 units of graduate courses for a total of 18 graduate units including 12 units of engineering courses listed in # (iii) above. The remaining 6 units can be graduate or upper division courses not required for EBS BS degree
- (v) At most 9 units of 290C, 299 Research
- (vi) Other graduate or upper division courses for a total of at least 36 units. For those students who did not take any life sciences classes during their undergraduate degree program, at least one course from life sciences should be included.
- (vii) Written engineering report based on a project and oral comprehensive examination before a three faculty committee members.

### 3. Course Requirements

#### MS Plan I - Core and Electives (30 units)

##### a) Core courses (3 units)

EBS 200 Research methods in biological systems engineering	2 units
EBS290 Seminar course	1 unit

**b) Elective Courses (minimum of 27 units):** These courses should be selected in consultation with the course guidance committee members and should meet the requirements stated in #2 above for MS Plan I.

**c) Summary:** Figure 2 succinctly summarizes our MS Plan I degree program requirements.

#### MS Plan II - - Core and Electives (36 units)

**a) Core courses (3 units)**

EBS 200 Research methods in biological systems engineering 2 units

EBS290 Seminar course 1 unit

**b) Elective Courses (minimum of 33 units):** These courses should be selected in consultation with the course guidance committee members and should meet the requirements stated in #2 above for MS Plan II.

**c) Summary:** Figure 3 succinctly summarizes our MS II degree program requirements.

#### M. Engr - Core and Electives (36 units)

**a) Core courses (3 units)**

EBS 200 Research methods in biological systems engineering 2 units

EBS290 Seminar course 1 unit

**b) Elective Courses (minimum of 33 units):** These courses should be selected in consultation with the course guidance committee members and should meet the requirements stated in #2 above for M. Engr.

**c) Summary:** Figure 4 succinctly summarizes our M. Engr. degree program requirements.

#### 4. Special Requirements: None.

#### 5. Committees:

a) **Admission Committee:** The graduate admission adviser and staff adviser handle all application-related issues. Once the completed application, all supporting material, and the application fee have been received, the application will be submitted to the Admissions Committee. In consultation with the graduate program chair, the graduate admission adviser will make the admission recommendation and forward it to the Dean of the Office of Graduate Studies for final approval of admission

b) **Course Guidance or Advising Committee:** Upon acceptance into the program, students are required to meet with an assigned major professor in their primary technical area of interest to formulate their proposed Program of Study. A Program of Study is a list of graded courses the student is expected to take to meet degree requirements. Course Guidance Committee assists the student in developing this program of study. It should be signed by all three members of

the course guidance committee before it is submitted to the Executive Committee. Students pursuing MS Plan I or M. Engr. Degree must submit their Program of Study to the Executive Committee for approval by the end of Winter quarter. Students pursuing MS Plan II program should submit their Program of Study by the end of Fall quarter to the Executive Committee for approval.

- c) **Thesis Committee (MS Plan I) /Comprehensive Examination Committee (MS Plan II, M. Engr):** Students who are pursuing MS Plan I are required to set up a Thesis Committee at the time of Advancement to Candidacy. Students Pursuing MS Plan II or M. Engr degree are required to set up a Comprehensive Examination Committee at the time of Advancement to Candidacy. This committee of three is nominated by the student in consultation with his/her major professor and submitted to the Graduate Adviser for approval. These nominations are then submitted to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy. The major professor acts as Chair of the committee.

6. **Advising Structure and Mentoring:** The graduate adviser will go over the degree requirements with all admitted graduate students. For students entering in the Fall quarter, this is done as a part of EBS 200 course (Research methods in biological systems engineering) within the first couple of weeks of the quarter. For a student entering in other quarters (early or late admits), the Graduate Adviser will go over these requirements on an individual basis soon after arrival of the student. The Graduate Adviser and the staff adviser are available to discuss all matters pertinent to the graduate program. Students admitted to the Biological Systems Engineering Graduate Program work closely with their respective major professors. The **Mentoring Guidelines** can be found at

<http://bae.engineering.ucdavis.edu/graduate/masters-students-guide/>

7. **Advancement to Candidacy:** Students admitted to the Masters degree program must file the advancement to candidacy form when they finish all or majority of the coursework listed on their program of study. The Candidacy for the Degree of Master form can be found online at: <http://www.gradstudies.ucdavis.edu/forms/>. A completed form along with appropriate fees must be submitted before the thesis can be submitted (MS Plan I) or Comprehensive Examination can be taken (MS Plan II or M. Engr). The form includes a list of courses the student will take to complete degree requirements. If changes must be made to the student's course plan after s/he has advanced to candidacy, the Graduate Adviser must recommend these changes to Graduate Studies. Students must have their Graduate Adviser and committee Chair sign the candidacy form before it can be submitted to Graduate Studies. If the candidacy is approved, the Office of Graduate Studies will send a copy to the appropriate Graduate Program Coordinator and the student. If the Office of Graduate Studies determines that a student is not eligible for advancement, the program and the student will be told the reasons for the application's deferral. Some reasons for deferring an application include: grade point average below 3.0, outstanding "I" grades in required courses, or insufficient units.

## 8. Comprehensive Examination and/or Thesis Requirements

### a) **Thesis requirements (MS Plan I):**

Thesis: Research for the Master's thesis is to be carried out under the supervision of a faculty member of the program and must represent an original contribution to knowledge in the field.

The thesis research must be conducted while the student is enrolled in the program. The thesis is submitted to the thesis committee at least one month before the student plans to make requested revisions. All committee members must approve the thesis and sign the title page before the thesis is submitted to Graduate Studies for final approval. Should the committee determine that the thesis is unacceptable, even with substantial revisions, the program may recommend to the Dean of the Office of Graduate Studies that the student be disqualified from the program.

The thesis must be filed in a quarter in which the student is registered or on filing fee. Instructions on preparation of the thesis and a schedule of dates for filing the thesis in final form are available from Graduate Studies; the dates are also printed in the UC Davis General Catalog and in the Class Schedule and Registration Guide issued each quarter. A student must have a GPA of 3.0 for the M.S. degree to be awarded.

**b) Comprehensive Examination Requirements (MS Plan II/M. Engr.):**

i) **Timing:** At the time of advancement to candidacy, students pursuing this option must set up a comprehensive examination committee of three faculty members in consultation with their major professor and submit it to the Graduate Adviser for approval. The chair of the examination committee and at least one other member must be in the Biological Systems Engineering Graduate Program. The format of the examination will be oral.

ii) **Outcome:** The exam committee's unanimous vote is required for a student to pass the exam. If a student does not pass the first exam, the committee may recommend that the student be examined a second time, but only if the Graduate Adviser concurs with the committee. The second exam must take place within one quarter of the first exam. The format of the second exam is the same as that of the first exam and may include the submission of an amended version of the report. The examination may not be repeated more than once. A student who does not pass on the second attempt will be recommended for disqualification from further graduate work to the Dean of the Office of Graduate Studies..

Once passed, the Master's Report Form is signed by the Program Graduate Adviser and then forwarded to the Office of Graduate Studies. The deadlines for completing this requirement are listed each quarter in the campus General Catalog (available online at the website of the Office of the Registrar). A candidate must be a registered student or in Filing Fee status at the time the program submits the form, with the exception of the summer period between the end of the Spring Quarter and the beginning of Fall Quarter. The program must file the report with Graduate Studies within one week of the end of the quarter in which the student's degree will be conferred.

*In addition to passing the Comprehensive Examination, the M. Engr. Students must also submit a report that is approved by the Comprehensive Examination Committee.* The Master of Engineering report is based on supervised study carried out for credit under the 290C and 299 course numbers. The study may comprise library, laboratory, or field work, and is directed toward the solution of a specific engineering problem. Examples of appropriate report activities are design of components or systems, critical studies of existing systems, model studies, and field surveys. The form and quality of the report must conform to generally accepted standards of the engineering profession.

**9. Normative time to degree:** Normative time to degree is 2 years for MS Plan I and M. Engr degrees. For MS Plan II normative time is 4 quarters.

**10. Typical timeline and sequence of events:**

**MS Plan I (Thesis option):**

Year	Fall	Winter	Spring	Summer
1	200 (2 units) + 3 units of graduate or upper division courses + 1 unit of 290 C + 299 (6 units)  Select guidance committee	6 units of graduate or upper division courses + 290C (1 unit) + 299 (5 units)  Submit Program of Study	6 units of graduate or upper division courses + 290C (1 unit) + 299 (5 units)	Conduct Research
2	3 units of graduate or upper division courses + 1 unit of 290C + 8 units of 299.	1 unit 290C + 11 units of 299.	1 unit of 290C + 11 units of 299.	Present exit seminar and submit thesis.

**MS Plan II (Comprehensive Exam option):**

Year	Fall	Winter	Spring	Summer
1	200 (2 units) + 7 units of graduate or upper division courses + 1 unit of 290 C + 299 (2 units)  Select guidance committee/submit program of study	9 units of graduate or upper division courses + 290C (1 unit) + 299 (2 units)	9 units of graduate or upper division courses + 290C (1 unit) + 299 (2 units)	Take Comprehensive examination

**M. Engr (Project + Comprehensive Examination option):**

Year	Fall	Winter	Spring	Summer
1	200 (2 units) + 3 units of graduate or upper division courses + 1 unit of 290 C + 299 (6 units) Select guidance committee	8 units of graduate or upper division courses + 290C (1 unit) + 299 (3 units) Submit Program of study	8 units of graduate or upper division courses + 290C (1 unit) + 299 (3 units)	Pursue Engineering project
2	6 units of graduate or upper division courses + 1 unit of 290C + 5 units of 299	1 unit 290C + 11 units of 299	1 unit of 290C + 11 units of 299.	Submit the report and take the comprehensive examination

**11. Sources of Funding:** Almost all students in Biological Systems Engineering Graduate Program except for those in MS Plan II, are employed as Graduate Student Researchers (GSR), or Teaching Assistants (TA), or hold fellowships such as Biological Systems Engineering Fellowship, University Fellowships, or External Fellowships. These assistantships and fellowships are very competitive. Since MS Plan II does not involve a research thesis, Graduate Student Researcher (GSR) opportunities will be rare for students in the MS Plan II program. However, those in the MS Plan II program are eligible for a limited number of Teaching Assistantship (TA) positions within the department and may apply for TA positions elsewhere on campus. Furthermore, limited scholarships and fellowships are available to highly qualified students.

**12. PELP and Filing Fee Status:** The planned educational leave program (PELP) is available to students to suspend their program of studies for good cause (i.e. illness, temporary departure from the University for employment or research away from campus, financial problems, personal problems). Students on PELP may leave the campus and be guaranteed the right to return later to resume academic work. The minimum duration of PELP is one quarter and maximum duration is three quarters.

Note that students in the MS Plan II degree program are not eligible for Filing Fee status as there is no thesis requirement in this degree.

Additional information about PELP (Planned Educational Leave), In Absentia (reduced fees when researching out of state), and Filing Fee status can be found in the Graduate Student Guide: <http://www.gradstudies.ucdavis.edu/publications/>



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**M.S. (Plan I) Program of Study:**

<b>Minimum Required Total (30)*</b>	EBS 200 Research Methods (2)	
	EBS 290 Seminar (1)	
	Courses exclusive of EBS 200, EBS 290, 290C and 299 (17) Must meet these criteria:	Graduate or Upper Division Undergraduate Courses not required for EBS BS degree (5)
		Graduate Engineering Courses (12)
290C, 299 Research (minimum of 6 units required)  plus other Graduate or Upper Division Undergraduate Courses as needed to meet the required 30 unit minimum total		

**Note:** Requires written thesis and public presentation of research (exit seminar) for completion of degree. May require at least one course in the life sciences depending on background. \*(minimum number of course units except as noted).

**Figure 2. Course requirements for MS Plan I (Thesis option)**

M.S. (Plan II) Program of Study:

Minimum Required Total (36)*	EBS 200 Research Methods (2)	
	EBS 290 Seminar (1)	
	Courses exclusive of EBS 200, EBS 290, 290C and 299 (24) Must meet these criteria:	Graduate or Upper Division Undergraduate Courses not required for EBS BS degree (12)
		Graduate Engineering Courses (12)
290C, 299 Research (maximum of 9 units to count toward 36 unit minimum total) plus other Graduate or Upper Division Undergraduate Courses as needed to meet the required 36 unit minimum total		

Requires comprehensive oral examination for completion of degree. \*(minimum number of course units except as noted).

**Figure 3. Course requirements for MS Plan II (Comprehensive examination option)**

**M.Engr. Program of Study:**

Minimum Required Total (36)*	EBS 200 Research Methods (2)	
	EBS 290 Seminar (1)	
	Courses exclusive of EBS 200, EBS 290, 290C and 299 (24) Must meet these criteria:	Graduate or Upper Division Undergraduate Courses not required for EBS BS degree (12)
		Graduate Engineering Courses (12)
290C, 299 Research (minimum of 6 units required) plus other Graduate or Upper Division Undergraduate Courses as needed to meet the required 36 unit minimum total		

**Note:** Requires written engineering report and comprehensive oral examination for completion of degree. May require at least one course in the life sciences depending on background. Requires a minimum residency of three academic quarters. \*(minimum number of course units except as noted).

**Figure 4 . Course requirements for M.Engr. degree**