

# BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

The required courses provide a thorough grounding in the essentials of mechanical engineering. Elective courses taken as part of one of the areas of emphasis allow for specialization. The areas of emphasis currently offered are mechanical design, thermal-fluid systems, and robotics and controls. Graduates of the Mechanical Engineering program are expected to have, within a few years of graduation:

- Established themselves as practicing professionals or engaged in graduate study in mechanical engineering or a related area.
- Demonstrated an ability to be productive and responsible professionals.
- Acted as representatives of their profession in their communities.

The number of units required for graduation (<http://bulletin.sfsu.edu/undergraduate-education/#Major>) and the G.E. requirements (<http://bulletin.sfsu.edu/undergraduate-education/general-education/>) are described in the Undergraduate Education section of this Bulletin. For information common to all engineering students, see Undergraduate Programs in Engineering above.

Courses are scheduled during the day as well as the late afternoon and evening. Other information and assistance in selecting courses can be obtained from a major advisor, by calling (415) 338-1174, by emailing [engrassst@sfsu.edu](mailto:engrassst@sfsu.edu), or by writing to:

School of Engineering  
San Francisco State University  
Science Building  
1600 Holloway Avenue  
San Francisco, CA 94132.

## Applicants

Freshman applicants should have completed four years of high school mathematics, one year of high school chemistry, and one year of high school physics. Students are also encouraged to include courses in mechanical drawing and computer programming.

Community college transfers should complete the sequence of mathematics, chemistry, physics, and engineering courses listed in freshman and sophomore years under the "sample sequence of courses" at the community college.

## Program Learning Outcomes

Upon completion of the Bachelor of Science in Mechanical Engineering a student will be able to demonstrate:

1. an ability to apply knowledge of mathematics, science, and engineering.
2. an ability to design and conduct experiments, as well as to analyze and interpret data.
3. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. an ability to function on multidisciplinary teams.
5. an ability to identify, formulate, and solve engineering problems.

6. an understanding of professional and ethical responsibility.
7. an ability to communicate effectively.
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
9. a recognition of the need for, and ability to engage in life-long learning.
10. knowledge of contemporary issues.
11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

## Mechanical Engineering (B.S.) – 93 units minimum

All courses for the major must be completed with a letter grade.

### General Education Requirements Met in the Major

The requirements below are deemed "met in the major" upon completion of the courses listed (even though the courses and their prerequisites are not approved for GE). This is true whether or not the student completes the major.

- Area A3 (Critical Thinking) is satisfied upon completion of ENGR 205 and either ENGR 201 or ENGR 213.
- Upper-Division General Education, Physical and Life Sciences (UD-B) is satisfied upon completion of ENGR 300 and either ENGR 301 or ENGR 302.

### Required Courses (77-79 Units)

Code	Title	Units
CHEM 115	General Chemistry I: Essential Concepts of Chemistry	3-5
	or CHEM 180 Chemistry for Energy and the Environment	
ENGR 100	Introduction to Engineering	1
ENGR 101	Engineering Graphics	1
ENGR 102	Statics	3
ENGR 103	Introduction to Computers	1
ENGR 200	Materials of Engineering	3
ENGR 201	Dynamics	3
ENGR 205	Electric Circuits	3
ENGR 206	Circuits and Instrumentation Laboratory	1
ENGR 300	Engineering Experimentation	3
ENGR 302	Experimental Analysis	1
ENGR 303	Engineering Thermodynamics	3
ENGR 304	Mechanics of Fluids	3
ENGR 307	Systems Dynamics and Mechanical Vibrations	3
ENGR 309	Mechanics of Solids	3
ENGR 364	Materials and Manufacturing Processes	3
ENGR 463	Thermal Power Systems	3
ENGR 464	Mechanical Design	3
ENGR 467	Heat Transfer	3
ENGR 696	Engineering Design Project I	1
ENGR 697GW	Engineering Design Project II - GEAR	2
MATH 226	Calculus I	4
MATH 227	Calculus II	4
MATH 228	Calculus III	4

MATH 245	Elementary Differential Equations and Linear Algebra	3
PHYS 220 & PHYS 222	General Physics with Calculus I and General Physics with Calculus I Laboratory	4
PHYS 230 & PHYS 232	General Physics with Calculus II and General Physics with Calculus II Laboratory	4
PHYS 240 & PHYS 242	General Physics with Calculus III and General Physics with Calculus III Laboratory	4

### Lower-Division Modular Electives (3 units)

Select a total of 3 units from:

Code	Title	Units
ENGR 271	Introduction to MATLAB	1
ENGR 272	Engineering Project Management	1
ENGR 291	Introduction to Creo Parametric	1
ENGR 292	Introduction to Solid Works - Level I	1
ENGR 294	Introduction to Microcontrollers	1
ENGR 295	Design Methodology	1

### Emphasis Elective (4 Units)

Units selected from the following, depending on the area of emphasis:

Code	Title	Units
ENGR 410 & ENGR 411	Process Instrumentation and Control and Instrumentation and Process Control Laboratory	4
ENGR 447 & ENGR 446	Control Systems and Control Systems Laboratory	4

### Upper-Division Engineering Electives (9 Units)

Choice of upper-division electives must present a clearly identifiable educational objective and ensure that the program requirements in engineering science and design are met by all students. Distribution of credit units among engineering science and design is given in the *Advising Guide*. A study plan of intended upper-division electives must be approved by the student's advisor and the program coordinator prior to the seventh semester of the engineering program.

A total of 9 units from the following list of courses is required, subject to the minimum number of units specified for each group. Courses selected for the controls (emphasis) elective may not be double-counted as upper-division electives.

Code	Title	Units
ENGR 306	Electromechanical Systems	3
ENGR 410	Process Instrumentation and Control	3
ENGR 411	Instrumentation and Process Control Laboratory	1
ENGR 415	Mechatronics	4
ENGR 432	Finite Element Methods in Structural and Continuum Mechanics	3
ENGR 441	Fundamentals of Composite Materials	3
ENGR 446	Control Systems Laboratory	1
ENGR 447	Control Systems	3
ENGR 465	Principles of HVAC	3
ENGR 466	Gas Dynamics and Boundary Layer Flow	3
ENGR 468	Applied Fluid Mechanics and Hydraulics	3
ENGR 469	Alternative and Renewable Energy Systems	3

ENGR 470	Biomechanics	3
ENGR 610	Engineering Cost Analysis	3
ENGR 699	Independent Study	1-2
ENGR 820	Energy Resources and Sustainability	3
ENGR 860	Applied Engineering Analysis	3
ENGR 863	Advanced Thermal-Fluids	3
ENGR 864	Transport Phenomena	3
ENGR 865	Energy-Efficient Buildings	3
ENGR 866	Air Quality Engineering	3
ENGR 867	Energy Auditing and Measurement and Verification	3
ENGR 868	Advanced Control Systems	3
ENGR 869	Robotics	3
ENGR 870	Robot Control	3
ENGR 871	Advanced Electrical Power Systems	3

### General Education Requirements

Requirement	Course Level	Units	Area Designation
Oral Communication	LD	3	A1
Written English Communication	LD	3	A2
Critical Thinking	LD	3	A3
Physical Science	LD	3	B1
Life Science	LD	3	B2
Lab Science	LD	1	B3
Mathematics/Quantitative Reasoning	LD	3	B4
Arts	LD	3	C1
Humanities	LD	3	C2
Arts or Humanities	LD	3	C1 or C2
Social Sciences	LD	3	D1
Social Sciences: US History	LD	3	D2
Lifelong Learning and Self-Development (LLD)	LD	3	E
Ethnic Studies	LD	3	F
Physical and/or Life Science	UD	3	UD-B
Arts and/or Humanities	UD	3	UD-C
Social Sciences	UD	3	UD-D
<b>SF State Studies</b>			
Courses certified as meeting the SF State Studies requirements may be upper or lower division in General Education (GE), a major or minor, or an elective.			
American Ethnic and Racial Minorities	LD or UD	3	AERM
Environmental Sustainability	LD or UD	3	ES

Global Perspectives	LD or UD	3	GP
Social Justice	LD or UD	3	SJ

Note: LD = Lower-Division; UD = Upper-Division.

## First-Time Student Roadmap (4 Year)

Find the correct roadmap (A, B, C, or D):

1. Select the row that matches your English Course choice for A2.\*
2. Select the column that matches your QR Category (found at your student center under Math Alert).
3. Click the Roadmap that lines up with your row and column.

For example, if you are taking ENG 104 as your first English course and your student center math alert says you are QR Category III, you should choose Roadmap D.

Course Choice	One-Semester Course	Two-Semester Sequence or Support Course
ENG 114	Roadmap A ( <a href="http://bulletin.sfsu.edu/colleges/science-engineering/engineering/bs-mechanical-engineering/roadmap-ii-eng/">http://bulletin.sfsu.edu/colleges/science-engineering/engineering/bs-mechanical-engineering/roadmap-ii-eng/</a> )	Roadmap C ( <a href="http://bulletin.sfsu.edu/colleges/science-engineering/engineering/bs-mechanical-engineering/roadmap-iii-iv-eng/">http://bulletin.sfsu.edu/colleges/science-engineering/engineering/bs-mechanical-engineering/roadmap-iii-iv-eng/</a> )
ENG 104/ENG 105	Roadmap B ( <a href="http://bulletin.sfsu.edu/colleges/science-engineering/engineering/bs-mechanical-engineering/roadmap-ii-stretch/">http://bulletin.sfsu.edu/colleges/science-engineering/engineering/bs-mechanical-engineering/roadmap-ii-stretch/</a> )	Roadmap D ( <a href="http://bulletin.sfsu.edu/colleges/science-engineering/engineering/bs-mechanical-engineering/roadmap-iii-iv-stretch/">http://bulletin.sfsu.edu/colleges/science-engineering/engineering/bs-mechanical-engineering/roadmap-iii-iv-stretch/</a> )

\*Composition for Multilingual Students: If taking ENG 209 as your first English course, choose the ENG 114 row. If taking ENG 204 for your first English course, choose the ENG 104/ENG 105 row.

## SF State Scholars

The San Francisco State Scholars program provides undergraduate students with an accelerated pathway to a graduate degree. Students in this program pursue a bachelor's and master's degree simultaneously. This program allows students to earn graduate credit while in their junior and/or senior year, reducing the number of semesters required for completion of a master's degree.

This roadmap opens in a new tab. (<http://bulletin.sfsu.edu/colleges/science-engineering/engineering/bs-mechanical-engineering/scholar-roadmap/>)

## General Advising Information for Transfer Students

1. Before transfer, complete as many lower-division requirements or electives for this major as possible.
2. The following courses are not required for admission but are required for graduation. Students are strongly encouraged to complete these

units before transfer; doing so will provide more flexibility in course selection after transfer.

- a course in U.S. History
- a course in U.S. & California Government

For information about satisfying the requirements described in (1) and (2) above at a California Community College (CCC), please visit <http://www.assist.org> (<http://assist.org>). Check any geographically accessible CCCs; sometimes options include more than one college. Use ASSIST to determine:

- Which courses at a CCC satisfy any lower-division major requirements for this major;
- Which courses at a CCC satisfy CSU GE, US History, and US & CA Government requirements.

Remedial courses are not transferable and do not apply to the minimum 60 semester units/90 quarter units required for admission.

Additional units for courses that are repeated do not apply to the minimum 60 units required for upper-division transfer (for example, if a course was not passed on the first attempt or was taken to earn a better grade).

Before leaving the last California Community College of attendance, obtain a summary of completion of lower-division General Education units (IGETC or CSU GE Breadth). This is often referred to as a GE certification worksheet. SF State does not require delivery of this certification to Admissions, but students should retain this document for verifying degree progress after transfer.

Credit for Advanced Placement, International Baccalaureate, or College-Level Examination Program courses: AP/IB/CLEP credit is not automatically transferred from the previous institution. Units are transferred only when an official score report is delivered to SF State. Credit is based on the academic year during which exams were taken. Refer to the University Bulletin in effect during the year of AP/IB/CLEP examination(s) for details regarding the award of credit for AP/IB/CLEP.

Students pursuing majors in science, technology, engineering, and mathematics (STEM) disciplines often defer 6-9 units of lower-division General Education in Areas C and D until after transfer to focus on preparation courses for the major. This advice does not apply to students pursuing associate degree completion before transfer.

## Transferring From Institutions Other Than CCCs or CSUs

Review SF State's lower-division General Education requirements. Note that, as described below, the four basic skills courses required for admission meet A1, A2, A3, and B4 in the SF State GE pattern. Courses that fulfill the remaining areas of SF State's lower-division GE pattern are available at most two-year and four-year colleges and universities.

Of the four required basic skills courses, a course in critical thinking (A3) may not be widely offered outside the CCC and CSU systems. Students should attempt to identify and take an appropriate course no later than the term of application to the CSU. To review more information about the A3 requirement, please visit [bulletin.sfsu.edu/undergraduate-education/general-education/lower-division/#AEL](http://bulletin.sfsu.edu/undergraduate-education/general-education/lower-division/#AEL).

Waiting until after transfer to take a single course at SF State that meets both US and CA/local government requirements may be an appropriate option, particularly if transferring from outside of California.

## **All Students Must Meet the Transfer Eligibility Requirements Outlined Below for Admission.**

For more information, visit the Undergraduate Admissions section (<http://bulletin.sfsu.edu/undergraduate-admissions/>).

- Complete 60 or more transferable semester units or 90 or more quarter units.
- Earn a college grade point average of 2.0 or better in all transferable courses. Non-local area residents may be held to a higher GPA standard.
- Be in good standing at the last college or university attended.
- Complete 30-semester units (45-quarter units) of General Education, including four basic skills courses:
  - a. One course in oral communication (same as CSU GE Area A1)
  - b. One course in written composition (same as CSU GE Area A2)
  - c. One course in critical thinking (same as CSU GE Area A3)
  - d. One course in mathematics or quantitative reasoning (same as CSU GE Area B4)
- The four basic skills courses and a minimum of 60 transferable semester units (90-quarter units) must be completed by the spring semester prior to fall admission, or by the fall semester prior to spring admission. Earn a C- or better grade in each basic skills course.