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 engrasst@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)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 115 or CHEM 180</td>
<td>General Chemistry I: Essential Concepts of Chemistry or Chemistry for Energy and the Environment</td>
<td>3-5</td>
</tr>
<tr>
<td>ENGR 100</td>
<td>Introduction to Engineering</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 101</td>
<td>Engineering Graphics</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 102</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 103</td>
<td>Introduction to Computers</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 200</td>
<td>Materials of Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 201</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 205</td>
<td>Electric Circuits</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 206</td>
<td>Circuits and Instrumentation Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 300</td>
<td>Engineering Experimentiation</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 302</td>
<td>Experimental Analysis</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 303</td>
<td>Engineering Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 304</td>
<td>Mechanics of Fluids</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 307</td>
<td>Systems Dynamics and Mechanical Vibrations</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 309</td>
<td>Mechanics of Solids</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 364</td>
<td>Materials and Manufacturing Processes</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 463</td>
<td>Thermal Power Systems</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 464</td>
<td>Mechanical Design</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 467</td>
<td>Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 696</td>
<td>Engineering Design Project I</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 697GW</td>
<td>Engineering Design Project II - GWAR</td>
<td>2</td>
</tr>
<tr>
<td>MATH 226</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 227</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 228</td>
<td>Calculus III</td>
<td>4</td>
</tr>
</tbody>
</table>
Lower-Division Modular Electives (3 units)
Select a total of 3 units from:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 271</td>
<td>Introduction to MATLAB</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 272</td>
<td>Engineering Project Management</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 291</td>
<td>Introduction to Creo Parametric</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 292</td>
<td>Introduction to Solid Works - Level I</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 294</td>
<td>Introduction to Microcontrollers</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 295</td>
<td>Design Methodology</td>
<td>1</td>
</tr>
</tbody>
</table>

Emphasis Elective (4 Units)
Units selected from the following, depending on the area of emphasis:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 410</td>
<td>Process Instrumentation and Control</td>
<td>4</td>
</tr>
<tr>
<td>&amp; ENGR 411</td>
<td>and Instrumentation and Process Control Laboratory</td>
<td></td>
</tr>
<tr>
<td>ENGR 447</td>
<td>Control Systems</td>
<td>4</td>
</tr>
<tr>
<td>&amp; ENGR 446</td>
<td>and Control Systems Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 306</td>
<td>Electromechanical Systems</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 410</td>
<td>Process Instrumentation and Control</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 411</td>
<td>Instrumentation and Process Control Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 415</td>
<td>Mechatronics</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 432</td>
<td>Finite Element Methods in Structural and Continuum Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 441</td>
<td>Fundamentals of Composite Materials</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 446</td>
<td>Control Systems Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 447</td>
<td>Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 465</td>
<td>Principles of HVAC</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 466</td>
<td>Gas Dynamics and Boundary Layer Flow</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 468</td>
<td>Applied Fluid Mechanics and Hydraulics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 469</td>
<td>Alternative and Renewable Energy Systems</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 470</td>
<td>Biomechanics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 610</td>
<td>Engineering Cost Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 699</td>
<td>Independent Study</td>
<td>1-2</td>
</tr>
<tr>
<td>ENGR 820</td>
<td>Energy Resources and Sustainability</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 850</td>
<td>Applied Engineering Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 863</td>
<td>Advanced Thermal-Fluids</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 864</td>
<td>Transport Phenomena</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 865</td>
<td>Energy-Efficient Buildings</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 866</td>
<td>Air Quality Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 867</td>
<td>Energy Auditing and Measurement and Verification</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 868</td>
<td>Advanced Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 869</td>
<td>Robotics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 870</td>
<td>Robot Control</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 871</td>
<td>Advanced Electrical Power Systems</td>
<td>3</td>
</tr>
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</table>

General Education Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Level</th>
<th>Units</th>
<th>Area Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral Communication</td>
<td>LD</td>
<td>3</td>
<td>A1</td>
</tr>
<tr>
<td>Written English</td>
<td>LD</td>
<td>3</td>
<td>A2</td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>LD</td>
<td>3</td>
<td>A3</td>
</tr>
<tr>
<td>Physical Science</td>
<td>LD</td>
<td>3</td>
<td>B1</td>
</tr>
<tr>
<td>Life Science</td>
<td>LD</td>
<td>3</td>
<td>B2</td>
</tr>
<tr>
<td>Lab Science</td>
<td>LD</td>
<td>1</td>
<td>B3</td>
</tr>
<tr>
<td>Mathematics/</td>
<td>LD</td>
<td>3</td>
<td>B4</td>
</tr>
<tr>
<td>Quantitative Reasoning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arts</td>
<td>LD</td>
<td>3</td>
<td>C1</td>
</tr>
<tr>
<td>Humanities</td>
<td>LD</td>
<td>3</td>
<td>C2</td>
</tr>
<tr>
<td>Arts or Humanities</td>
<td>LD</td>
<td>3</td>
<td>C1 or C2</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>LD</td>
<td>3</td>
<td>D1</td>
</tr>
<tr>
<td>Social Sciences:</td>
<td>LD</td>
<td>3</td>
<td>D2</td>
</tr>
<tr>
<td>US History</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lifelong Learning and Self-Development (LLD)</td>
<td>LD</td>
<td>3</td>
<td>E</td>
</tr>
<tr>
<td>Ethnic Studies</td>
<td>LD</td>
<td>3</td>
<td>F</td>
</tr>
<tr>
<td>Physical and/or Life Science</td>
<td>UD</td>
<td>3</td>
<td>UD-B</td>
</tr>
<tr>
<td>Arts and/or Humanities</td>
<td>UD</td>
<td>3</td>
<td>UD-C</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>UD</td>
<td>3</td>
<td>UD-D</td>
</tr>
</tbody>
</table>

SF State Studies
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.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Level</th>
<th>Area Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Ethnic and Racial Minorities</td>
<td>LD or UD</td>
<td>AERM</td>
</tr>
<tr>
<td>Environmental Sustainability</td>
<td>LD or UD</td>
<td>ES</td>
</tr>
</tbody>
</table>

Bachelor of Science in Mechanical Engineering
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)

1. In order to choose your English Composition A2 course and your QR/Math B4 course, please complete the online advising activities at writingadvising.sfsu.edu (https://writingadvising.sfsu.edu/) and mathadvising.sfsu.edu (https://mathadvising.sfsu.edu/). Questions? Contact Gator Smart Start. (https://gatorsmartstart.sfsu.edu)

2. Select the row that matches your English course choice for A2.*
3. Select the column that matches your QR/Math course choice for B4.
4. Click the Roadmap that lines up with your row and column.

For example, if you select ENG 104/ENG 105 and a multi-semester QR/math sequence for your first year, then choose Roadmap D.

<table>
<thead>
<tr>
<th>Course Choice</th>
<th>One-Semester Course</th>
<th>Two-Semester Sequence or Support Course</th>
</tr>
</thead>
</table>

* Composition for Multilingual Students: If taking ENG 209 as your first English course, choose the ENG 114 row. If taking ENG 201 or ENG 212 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;

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/#AAEL.
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.