BACHELOR OF SCIENCE IN COMPUTER ENGINEERING

Undergraduate Programs in Engineering

Freshman applicants 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," if available at the community college.

The Bachelor of Science in Civil, Computer, Electrical, and Mechanical Engineering require – 127, 128, 129, and 129 semester units, respectively. A minimum of 30 units must be earned in residence at SF State. Of these units, 24 must be upper division courses and 12 of these upper division units must be in the major. Major requirements, including mathematics, chemistry, and physics prerequisites, comprise – 93 units for civil engineering, 94 for computer engineering, 95 for electrical engineering and 95 units for mechanical engineering. For civil engineering, 50 of the required units are lower division and 43 units are upper division. For mechanical engineering, 51 of the required units are lower division and 44 units are upper division. For electrical engineering, 50 of the required units are lower division and 45 units are upper division. For computer engineering, 49 of the required units are lower division and 45 units are upper division. The remaining 33 units satisfy the balance of the university requirements including communication skills and general education in humanities and social sciences. Students are advised that, except for some general education (GE) courses, all courses which are to be counted toward completion of an engineering degree must be taken for a letter grade; the CR/NC option may not be used in this context.

Computer Engineer

Computer engineering is a multidisciplinary field with roots in electrical engineering and computer science that has grown to become a separate discipline in itself. Graduates of the computer engineering program are expected to have, within a few years of graduation:

• Established themselves as practicing professionals or engaged in graduate study in computer engineering or a related field.
• Demonstrated an ability to be productive and responsible professionals.

The first two years of the program are designed to build a strong background in mathematics and science to provide a basis for understanding the underlying analysis and modeling tools and physical principles that are common to all engineering. The last two years cover a rich set of hardware and software subjects to give students a broad background in computer engineering. This broad foundation enables students to adapt and extend their knowledge and skills more easily in the future. The curriculum also stresses problem-solving skills and teamwork. Through electives, students can choose to develop further breadth or in-depth knowledge in one of three areas: embedded systems, network systems, or multimedia systems.

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

A number of required and elective lecture courses in the computer engineering program have corresponding laboratory courses that students are either required or strongly encouraged to take concurrently. These course pairs are:

<table>
<thead>
<tr>
<th>Course Pair</th>
<th>Course 1</th>
<th>Course 2</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 205 &amp; ENGR 206</td>
<td>Electric Circuits and Circuits and Instrumentation Laboratory</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>ENGR 353 &amp; ENGR 301</td>
<td>Microelectronics and Microelectronics Laboratory</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>ENGR 356 &amp; ENGR 357</td>
<td>Digital Design and Digital Design Laboratory</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>ENGR 447 &amp; ENGR 446</td>
<td>Control Systems and Control Systems Laboratory</td>
<td>4</td>
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</tbody>
</table>

Students who drop or withdraw from any of these lecture courses must also drop or withdraw from the corresponding laboratory course, or they will be administratively dropped or withdrawn.

Students must complete 21 units of upper-division engineering units before registering for ENGR 696.

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

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

General Education Requirements Met in the Engineering Major (All Concentrations)

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 one of ENGR 201 or ENGR 213.
• Upper Division General Education, Physical and Life Sciences (UD-B) is satisfied upon completion of ENGR 300 and one of ENGR 301 or ENGR 302.

Computer Engineering (B.S.) – 92 units minimum

Required Courses (86-88 units)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>CHEM 115</td>
<td>General Chemistry I: Essential Concepts of Chemistry</td>
<td>3-5</td>
</tr>
<tr>
<td>or CHEM 180</td>
<td>Chemistry for the Energy and the Environment</td>
<td></td>
</tr>
<tr>
<td>CSC 210</td>
<td>Introduction to Computer Programming</td>
<td>3</td>
</tr>
<tr>
<td>CSC 220</td>
<td>Data Structures</td>
<td>3</td>
</tr>
<tr>
<td>CSC 230</td>
<td>Discrete Mathematical Structures for Computer Science</td>
<td>3</td>
</tr>
</tbody>
</table>
CSC 340  Programming Methodology  3
CSC 413  Software Development  3
ENGR 100  Introduction to Engineering  1
ENGR 121  Gateway to Computer Engineering  1
ENGR 205  Electric Circuits  3
ENGR 206  Circuits and Instrumentation Laboratory  1
ENGR 212  Introduction to Unix and Linux for Engineers  2
ENGR 213  Introduction to C Programming for Engineers  3
ENGR 300  Engineering Experimentation  3
ENGR 301  Microelectronics Laboratory  1
ENGR 305  Linear Systems Analysis  3
ENGR 353  Microelectronics  3
ENGR 356  Digital Design  3
ENGR 357  Digital Design Laboratory  1
ENGR 451  Digital Signal Processing  4
ENGR 476  Computer Communications Networks  3
ENGR 478  Design with Microprocessors  4
ENGR 478  Digital Systems Design  3
ENGR 456  Computer Systems  3
ENGR 496  Engineering Design Project I  1
ENGR 497GW  Engineering Design Project II-GWAR  2
MATH 227  Calculus II  4
MATH 226  Calculus I  4
MATH 228  Calculus III  4
MATH 245  Elementary Differential Equations and Linear Algebra  3
PHYS 220  General Physics with Calculus I and General Physics with Calculus I Laboratory  4
PHYS 222  General Physics with Calculus I and General Physics with Calculus I Laboratory  4
PHYS 230  General Physics with Calculus II and General Physics with Calculus II Laboratory  4

**Upper Division Electives (6 units)**

Choice of upper division electives must demonstrate a clearly identifiable educational objective and have an advisor's approval. A study plan of intended upper division electives must be approved by the student's advisor and the program coordinator prior to registering for ENGR 696.

A total of 6 units from the following list of courses is required. Students with a GPA of at least 3.0 and the required prerequisites may take graduate courses (numbered 800 and above) with the approval of their advisor or the program coordinator.

CSC 415  Operating System Principles  3
CSC 510  Analysis of Algorithms I  3
CSC 645  Computer Networks  3
CSC 648  Software Engineering  3
CSC 667  Internet Application Design and Development  3
CSC 668  Advanced Object Oriented Software Design and Development  3
ENGR 306  Electromechanical Systems  3
ENGR 350  Introduction to Engineering Electromagnetics  3
ENGR 442  Operational Amplifier Systems Design  3
ENGR 446  Control Systems Laboratory  1
ENGR 447  Control Systems  3
ENGR 449  Communication Systems  3
ENGR 453  Digital Integrated Circuit Design  4
ENGR 610  Engineering Cost Analysis  3
ENGR 844  Embedded Systems  3
ENGR 848  Digital VLSI Design  3
ENGR 849  Advanced Analog IC Design  3
ENGR 851  Advanced Microprocessor Architectures  3
ENGR 852  Advanced Digital Design  3
ENGR 853  Advanced Topics in Computer Communication and Networks  3
ENGR 854  Wireless Data Communication Standards  3
ENGR 856  Nanoscale Circuits and Systems  3
ENGR 868  Advanced Control Systems  3
ENGR 869  Robotics  3

**General Education Requirements**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Level</th>
<th>Units</th>
<th>Area Designation</th>
</tr>
</thead>
</table>
| Oral
Communication | LD | 3 | A1 |
| Written English
Communication I | LD | 3 | A2 |
| Critical Thinking | LD | 3 | A3 |
| Written English
Communication II | LD | 3 | A4 |
| 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 |
| Arts or Humanities | LD | 3 | C1 or C2 |
| Humanities: Literature | LD | 3 | C3 |
| Social Sciences | LD | 3 | D1 |
| Social Sciences: US History | LD | 3 | D2 |
| Social Sciences: US & CA Government | LD | 3 | D3 |

**SF State Studies**

Courses certified as meeting the SF State Studies requirements may be upper or lower division in General Education (GE), in a major or minor, or an elective.
American Ethnic and Racial Minorities (AERM)  
LD or UD  
3

Environmental Sustainability (ES)  
LD or UD  
3

Global Perspectives (GP)  
LD or UD  
3

Social Justice (SJ)  
LD or UD  
3

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

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
   - a 2nd-semester course in written English composition

For information about satisfying the requirements described in (1) and (2) above at a California Community College (CCC), please visit http://www.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, including 2nd-semester composition;

Remedial courses are not transferable and do not apply to the minimum 60 units/90 quarters 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 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 in order 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 (GE 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 http://bulletin.sfsu.edu/undergraduate-education/general-education/lower-division/#AAEL.

Identify and complete a 2nd-semester written English composition course before transfer. This is usually the next course after the typical “freshman comp” course, with a focus on reading, writing and critical analytical skills for academic purposes, and developing skills in composing, revising, and the use of rhetorical strategies.

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.

- Complete 60 or more transferable semester units or 90 or more quarter units
- Earn a college grade point average of 2.00 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, with intermediate algebra as a prerequisite (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.