BS SOFTWARE ENGINEERING

Program Learning Outcomes
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 multi-disciplinary 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 an ability to engage in life-long learning.
10. A knowledge of contemporary issues.
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Degree Requirements and Curriculum
In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (http://catalog.calpoly.edu/generalrequirementsbachelorsdegree/#generaleducationtext) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be selected as credit/no credit.

MAJOR COURSES

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC/CPE 101</td>
<td>Fundamentals of Computer Science</td>
<td>4</td>
</tr>
<tr>
<td>CSC/CPE 108</td>
<td>Accelerated Introduction to Computer Science</td>
<td>4</td>
</tr>
<tr>
<td>CSC/CPE 202</td>
<td>Data Structures</td>
<td>4</td>
</tr>
<tr>
<td>CSC/CPE 123</td>
<td>Introduction to Computing</td>
<td>4</td>
</tr>
<tr>
<td>CSC/CPE 203</td>
<td>Project-Based Object-Oriented Programming and Design</td>
<td>4</td>
</tr>
<tr>
<td>CSC 225</td>
<td>Introduction to Computer Organization</td>
<td>4</td>
</tr>
<tr>
<td>CSC 300</td>
<td>Professional Responsibilities</td>
<td>4</td>
</tr>
<tr>
<td>CSC 305</td>
<td>Individual Software Design and Development</td>
<td>4</td>
</tr>
<tr>
<td>CSC 308</td>
<td>Software Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>CSC 309</td>
<td>Software Engineering II</td>
<td>4</td>
</tr>
<tr>
<td>CSC 348</td>
<td>Discrete Structures</td>
<td>4</td>
</tr>
<tr>
<td>CSC 349</td>
<td>Design and Analysis of Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>CSC/CPE 357</td>
<td>Systems Programming</td>
<td>4</td>
</tr>
<tr>
<td>CSC 402</td>
<td>Software Requirements Engineering</td>
<td>4</td>
</tr>
<tr>
<td>CSC 405</td>
<td>Software Construction</td>
<td>4</td>
</tr>
<tr>
<td>CSC 406</td>
<td>Software Deployment</td>
<td>4</td>
</tr>
<tr>
<td>CSC 430</td>
<td>Programming Languages I</td>
<td>4</td>
</tr>
<tr>
<td>CSC 484</td>
<td>User-Centered Interface Design and Development</td>
<td>4</td>
</tr>
<tr>
<td>CSC 491 &amp; CSC 492</td>
<td>Senior Project I and Senior Project II</td>
<td>4</td>
</tr>
</tbody>
</table>

Select Technical Electives based on guidelines below 

SUPPORT COURSES

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 149</td>
<td>Technical Writing for Engineers (A3)</td>
<td>4</td>
</tr>
<tr>
<td>IME 314</td>
<td>Engineering Economics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 141</td>
<td>Calculus I (B1)</td>
<td>4</td>
</tr>
<tr>
<td>MATH 142</td>
<td>Calculus II (B1)</td>
<td>4</td>
</tr>
<tr>
<td>MATH 143</td>
<td>Calculus III (Add'l Area B)</td>
<td>4</td>
</tr>
<tr>
<td>MATH 241</td>
<td>Calculus IV</td>
<td>4</td>
</tr>
<tr>
<td>MATH 244</td>
<td>Linear Analysis I</td>
<td>4</td>
</tr>
<tr>
<td>PSY 201/202</td>
<td>General Psychology (D4)</td>
<td>4</td>
</tr>
<tr>
<td>PSY 350</td>
<td>Teamwork</td>
<td>4</td>
</tr>
<tr>
<td>or PSY 351</td>
<td>Group Dynamics</td>
<td></td>
</tr>
<tr>
<td>or COMS 217</td>
<td>Small Group Communication</td>
<td></td>
</tr>
<tr>
<td>STAT 312</td>
<td>Statistical Methods for Engineers (B6)</td>
<td>4</td>
</tr>
</tbody>
</table>

Life Science Support Electives:
Select from the following:  

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 111</td>
<td>General Biology (B2 &amp; B4)</td>
<td>4-5</td>
</tr>
<tr>
<td>BIO 161</td>
<td>Introduction to Cell and Molecular Biology (B2 &amp; B4)</td>
<td></td>
</tr>
<tr>
<td>BIO 213 &amp; BMED 213</td>
<td>Life Science for Engineers and Bioengineering Fundamentals (B2)</td>
<td></td>
</tr>
<tr>
<td>BOT 121</td>
<td>General Botany (B2 &amp; B4)</td>
<td></td>
</tr>
<tr>
<td>MCRO 221</td>
<td>Microbiology (B2 &amp; B4)</td>
<td></td>
</tr>
<tr>
<td>MCRO 224</td>
<td>General Microbiology I (B2 &amp; B4)</td>
<td></td>
</tr>
</tbody>
</table>

Mathematics Support Electives:
Select from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 248</td>
<td>Methods of Proof in Mathematics</td>
<td>4</td>
</tr>
<tr>
<td>MATH 304</td>
<td>Vector Analysis</td>
<td></td>
</tr>
<tr>
<td>MATH 335</td>
<td>Graph Theory</td>
<td></td>
</tr>
<tr>
<td>MATH 336</td>
<td>Combinatorial Math</td>
<td></td>
</tr>
<tr>
<td>MATH 451</td>
<td>Numerical Analysis I</td>
<td></td>
</tr>
</tbody>
</table>

Physical Science Support Electives
Select one of the following series:  

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 124 &amp; CHEM 125</td>
<td>General Chemistry for Physical Science and Engineering I</td>
<td></td>
</tr>
<tr>
<td>&amp; CHEM 125 &amp; CHEM 126</td>
<td>and General Chemistry for Physical Science and Engineering II</td>
<td></td>
</tr>
<tr>
<td>PHYS 141 &amp; PHYS 132</td>
<td>General Physics IA and General Physics II</td>
<td></td>
</tr>
<tr>
<td>&amp; PHYS 133</td>
<td>and General Physics III</td>
<td></td>
</tr>
</tbody>
</table>

GENERAL EDUCATION (GE)
FREE ELECTIVES

Free Electives

Total units 187-188

1 Required in Major/Support; also satisfies GE.
2 An additional 4 units of CPE/CSC technical electives may substitute, although new students are strongly encouraged to take CSC 123.
3 Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
4 An additional 4 units of CPE/CSC technical electives is needed if CSC 123 is not taken.

Technical Electives Guidelines

Courses used to satisfy any other Major, Support, or General Education requirement are not allowed to count toward Technical Elective requirement. Credit/No Credit grading is not allowed.

Contact the CSC Department for further information.

Select Technical Electives from the following:

CSC 301 Personal Software Process
CSC/CPE 321 Introduction to Computer Security
CSC 323 Cryptography Engineering
CSC 325 Introduction to Privacy: Policy and Technology
CSC 344 Music Programming
CSC 365 Introduction to Database Systems
CSC 366 Database Modeling, Design and Implementation
CSC 369 Introduction to Distributed Computing
CSC 371 Game Design
CSC 378 Interactive Entertainment Engineering
CSC 400 Special Problems
CSC 409 Current Topics in Software Engineering
CSC 410 Software Evaluation
CSC 422 Network and Web Security
CSC 424 Software Security
CSC 429 Current Topics in Computer Security
CSC/CPE 431 Programming Languages II
CSC 435 Introduction to Object Oriented Design Using Graphical User Interfaces
CSC 436 Mobile Application Development
CSC 437 Web Development
CSC 445 Theory of Computation I
CSC 448 Bioinformatics Algorithms
CSC/CPE 453 Introduction to Operating Systems
CSC/CPE 454 Implementation of Operating Systems
CSC/CPE 458 Current Topics in Computer Systems
CSC 466 Knowledge Discovery from Data

CSC 468 Database Management Systems Implementation
CSC/CPE 471 Introduction to Computer Graphics
CSC 473 Advanced Rendering Techniques
CSC 474 Computer Animation
CSC/CPE 476 Real-Time 3D Computer Graphics Software
CSC 477 Scientific and Information Visualization
CSC 478 Current Topics in Computer Graphics
CSC 480 Artificial Intelligence
CSC 481 Knowledge Based Systems
CSC 483 Current Topics in Human-Computer Interaction
CSC 486 Human-Computer Interaction Theory and Design
CSC 489 Current Topics in Artificial Intelligence
CSC 490 Selected Advanced Topics
CSC 508 Software Engineering I
CSC 509 Software Engineering II
CSC/CPE 515 Computer Architecture
CSC 521 Computer Security
CSC 530 Languages and Translators
CSC 540 Theory of Computation II
CSC 550 Operating Systems
CSC 560 Database Systems
CSC/CPE 564 Computer Networks: Research Topics
CSC 566 Topics in Advanced Data Mining
CSC/CPE 569 Distributed Computing
CSC 570 Current Topics in Computer Science
CSC 572 Computer Graphics
CSC 580 Artificial Intelligence
CSC 581 Computer Support for Knowledge Management
CSC 582 Introduction to Natural Language Processing
CPE 315 Computer Architecture
CPE 400 Special Problems for Undergraduates
CPE 416 Autonomous Mobile Robotics
CPE 419 Applied Parallel Computing
CPE/EE 428 Computer Vision
CPE 464 Introduction to Computer Networks
CPE 465 Advanced Computer Networks
CPE 482 Advanced Topics in Systems for Computer Engineering
CPE 485 Autonomous Robot Navigation
CPE 488/IME 458/MATE 458 Microelectronics and Electronics Packaging
DATA 301 Introduction to Data Science

The following restrictions must be satisfied...
4 of these units must be satisfied by a course that has as a prerequisite either

1) An upper-division course required by the major (excluding CSC 357 and CSC 348) or

2) Another technical elective

Select from the following:

- CSC 325 Introduction to Privacy: Policy and Technology
- CSC 366 Database Modeling, Design and Implementation
- CSC 409 Current Topics in Software Engineering
- CSC 410 Software Evaluation
- CSC 422 Network and Web Security
- CSC 424 Software Security
- CSC 429 Current Topics in Computer Security
- CSC/CPE 431 Programming Languages II
- CSC 435 Introduction to Object Oriented Design Using Graphical User Interfaces
- CSC 437 Web Development
- CSC/CPE 454 Implementation of Operating Systems
- CSC 466 Knowledge Discovery from Data
- CSC 468 Database Management Systems Implementation
- CSC 473 Advanced Rendering Techniques
- CSC 474 Computer Animation
- CSC/CPE 476 Real-Time 3D Computer Graphics Software
- CSC 477 Scientific and Information Visualization
- CSC 478 Current Topics in Computer Graphics
- CSC 481 Knowledge Based Systems
- CSC 483 Current Topics in Human-Computer Interaction
- CSC 486 Human-Computer Interaction Theory and Design
- CSC 489 Current Topics in Artificial Intelligence
- CSC 508 Software Engineering I
- CSC 509 Software Engineering II
- CSC/CPE 515 Computer Architecture
- CSC 521 Computer Security
- CSC 530 Languages and Translators
- CSC 540 Theory of Computation II
- CSC 550 Operating Systems
- CSC 560 Database Systems
- CSC/CPE 564 Computer Networks: Research Topics
- CSC 566 Topics in Advanced Data Mining
- CSC 572 Computer Graphics
- CSC 580 Artificial Intelligence
- CSC 581 Computer Support for Knowledge Management

CSC 582 Introduction to Natural Language Processing
CPE 416 Autonomous Mobile Robotics
CPE 465 Advanced Computer Networks

Up to 4 units may be taken from CSC 400, CPE 400, or CSC 490.

Up to 4 units may be taken from approved external electives.

Select from the following:

- AERO 450 Introduction to Aerospace Systems Engineering
- ART 384 Digital 3D Modeling and Design
- BUS 310 Introduction to Entrepreneurship
- CHEM 216 Organic Chemistry I
- CHEM 217 Organic Chemistry II
- CHEM 218 Organic Chemistry III
- CHEM 312 Survey of Organic Chemistry
- ECON 339 Econometrics
- EE 201 Electric Circuit Theory
- EE 251 and Electric Circuits Laboratory
- EE 314 Introduction to Communication Systems
- EE/CPE 336 Microprocessor System Design
- EE 424 Introduction to Remote Sensing
- ENVE 542 Sustainable Environmental Engineering
- IME 301 Operations Research I
- IME 356 Manufacturing Automation
- MATH 206 Linear Algebra I
- MATH 242 Differential Equations I
- MATH 248 Methods of Proof in Mathematics
- MATH 304 Vector Analysis
- MATH 341 Theory of Numbers
- MATH 350 Mathematical Software
- MATH 412 Introduction to Analysis I
- ME 211 Engineering Statics
- ME 212 Engineering Dynamics
- ME 405 Mechatronics
- PHIL 412 Epistemology
- PHIL 422 Philosophy of Mind
- PSY 329 Research Methods in Psychology
- PSY 333 Quantitative Research Methods for the Behavioral Sciences
- PSY 351 Group Dynamics
- PSY 457 Memory and Cognition
- STAT 313 Applied Experimental Design and Regression Models
- STAT 323 Design and Analysis of Experiments I
- STAT 324 Applied Regression Analysis
- STAT 330 Statistical Computing with SAS
- STAT 331 Statistical Computing with R
- STAT 416 Statistical Analysis of Time Series
- STAT 418 Categorical Data Analysis
- STAT 419 Applied Multivariate Statistics
A total of 20 technical elective units selected from upper-division and graduate CSC and CPE courses open to those in the major and not otherwise required by the major.
An additional 4 units of CPE/CSC technical electives may substitute for CSC 123 in major requirements.

### General Education (GE) Requirements

- 72 units required, 36 of which are specified in Major and/or Support.
- See the complete GE course listing (http://catalog.calpoly.edu/generalrequirementsbachelorsdegree/#generaleducationtext).
- Minimum of 8 units required at the 300 level.

<table>
<thead>
<tr>
<th>Area A</th>
<th>Communication</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Expository Writing</td>
<td>4</td>
</tr>
<tr>
<td>A2</td>
<td>Oral Communication</td>
<td>4</td>
</tr>
<tr>
<td>A3</td>
<td>Reasoning, Argumentation and Writing (4 units in Support)</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area B</th>
<th>Science and Mathematics</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Mathematics/Statistics (8 units in Support)</td>
<td>0</td>
</tr>
<tr>
<td>B2</td>
<td>Life Science (4 units in Support)</td>
<td>0</td>
</tr>
<tr>
<td>B3</td>
<td>Physical Science (4 units in Support)</td>
<td>0</td>
</tr>
<tr>
<td>B4</td>
<td>One lab taken with either a B2 or B3 course</td>
<td></td>
</tr>
<tr>
<td>B6</td>
<td>Upper-division Area B (4 units in Support)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Additional Area B units (8 units in Support)</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area C</th>
<th>Arts and Humanities</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Literature</td>
<td>4</td>
</tr>
<tr>
<td>C2</td>
<td>Philosophy</td>
<td>4</td>
</tr>
<tr>
<td>C3</td>
<td>Fine/Performing Arts</td>
<td>4</td>
</tr>
<tr>
<td>C4</td>
<td>Upper-division elective</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area D/E</th>
<th>Society and the Individual</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>The American Experience (Title 5, Section 40404 requirement) (40404)</td>
<td>4</td>
</tr>
<tr>
<td>D2</td>
<td>Political Economy</td>
<td>4</td>
</tr>
<tr>
<td>D3</td>
<td>Comparative Social Institutions</td>
<td>4</td>
</tr>
<tr>
<td>D4</td>
<td>Self Development (CSU Area E) (4 units in Support)</td>
<td>0</td>
</tr>
</tbody>
</table>

| Total units | 36 |

1 Required in Major/Support; also satisfies GE.