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 &amp; 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></td>
<td>Group Dynamics</td>
<td></td>
</tr>
<tr>
<td></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></td>
</tr>
<tr>
<td>BIO 161</td>
<td>Introduction to Cell and Molecular Biology (B2 &amp; B4)</td>
<td>3</td>
</tr>
<tr>
<td>BIO 213 &amp; BMED 213</td>
<td>Life Science for Engineers and Bioengineering Fundamentals (B2)</td>
<td>4</td>
</tr>
<tr>
<td>BOT 121</td>
<td>General Botany (B2 &amp; B4)</td>
<td>4</td>
</tr>
<tr>
<td>MCRO 221</td>
<td>Microbiology (B2 &amp; B4)</td>
<td>4</td>
</tr>
<tr>
<td>MCRO 224</td>
<td>General Microbiology I (B2 &amp; B4)</td>
<td>4</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>4</td>
</tr>
<tr>
<td>MATH 335</td>
<td>Graph Theory</td>
<td>4</td>
</tr>
<tr>
<td>MATH 336</td>
<td>Combinatorial Math</td>
<td>4</td>
</tr>
<tr>
<td>MATH 451</td>
<td>Numerical Analysis I</td>
<td>4</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>12</td>
</tr>
<tr>
<td>&amp; CHEM 126</td>
<td>General Chemistry for Physical Science and Engineering II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>General Chemistry for Physical Science and Engineering III</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>General Physics III</td>
<td></td>
</tr>
</tbody>
</table>

GENERAL EDUCATION (GE)
FREE ELECTIVES
Free Electives 0
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 Dynamic 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  Dynamic 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
Total units 20

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.

### Area A

<table>
<thead>
<tr>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
</tr>
<tr>
<td>A2</td>
</tr>
<tr>
<td>A3</td>
</tr>
</tbody>
</table>

### Area B

<table>
<thead>
<tr>
<th>Science and Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
</tr>
<tr>
<td>B2</td>
</tr>
<tr>
<td>B3</td>
</tr>
<tr>
<td>B4</td>
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<tr>
<td>B6</td>
</tr>
</tbody>
</table>

### Additional Area B units (8 units in Support)

### Area C

<table>
<thead>
<tr>
<th>Arts and Humanities</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
</tr>
<tr>
<td>C2</td>
</tr>
<tr>
<td>C3</td>
</tr>
<tr>
<td>C4</td>
</tr>
</tbody>
</table>

### Area D/E

<table>
<thead>
<tr>
<th>Society and the Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
</tr>
<tr>
<td>D2</td>
</tr>
<tr>
<td>D3</td>
</tr>
<tr>
<td>D4</td>
</tr>
</tbody>
</table>

Total units 36

Required in Major/Support; also satisfies GE.