BS COMPUTER SCIENCE

Program Learning Outcomes
1. An ability to apply knowledge of computing and mathematics appropriate to the discipline.
2. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
3. An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
4. An ability to function effectively on teams to accomplish a common goal.
5. An understanding of professional, ethical, legal, security, and social issues and responsibilities.
6. An ability to communicate effectively with a range of audiences.
7. An ability to analyze the local and global impact of computing on individuals, organizations, and society.
8. Recognition of the need for, and an ability to engage in continuing professional development.
9. An ability to use current techniques, skills, and tools necessary for computing practice.
10. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension and the tradeoffs involved in design choices.
11. An ability to apply design and development principles in the construction of software systems of varying complexity.

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 123</td>
<td>Introduction to Computing</td>
<td>4</td>
</tr>
<tr>
<td>Select from the following:</td>
<td></td>
<td></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 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>Select from the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSC 307</td>
<td>Introduction to Software Engineering</td>
<td>4</td>
</tr>
</tbody>
</table>

Support Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>CSC 308</td>
<td>Software Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; CSC 309</td>
<td>Software Engineering II</td>
<td>4</td>
</tr>
<tr>
<td>CPE 315</td>
<td>Computer Architecture</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 430</td>
<td>Programming Languages I</td>
<td>4</td>
</tr>
<tr>
<td>CSC/CPE 431</td>
<td>Programming Languages II</td>
<td>4</td>
</tr>
<tr>
<td>CSC 445</td>
<td>Theory of Computation I</td>
<td>4</td>
</tr>
<tr>
<td>CSC/CPE 453</td>
<td>Introduction to Operating Systems</td>
<td>4</td>
</tr>
<tr>
<td>CSC 491</td>
<td>Senior Project I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; CSC 492</td>
<td>Senior Project II (2, 2)</td>
<td>4</td>
</tr>
</tbody>
</table>

Concentration or Technical Electives 24

Select concentration, or select from the lists in technical electives guidelines below 4.5

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>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</td>
<td>4</td>
</tr>
<tr>
<td>MATH 206</td>
<td>Linear Algebra I</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 244</td>
<td>Linear Analysis I</td>
<td>4</td>
</tr>
<tr>
<td>STAT 312</td>
<td>Statistical Methods for Engineers (B6)</td>
<td>4</td>
</tr>
</tbody>
</table>

Life Science Support Elective

Select from the following: 4-5

<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)</td>
<td>1</td>
</tr>
<tr>
<td>BIO 161</td>
<td>Introduction to Cell and Molecular Biology (B2)</td>
<td>1</td>
</tr>
<tr>
<td>BIO 213</td>
<td>Life Science for Engineers</td>
<td>1</td>
</tr>
<tr>
<td>&amp; BMED 213</td>
<td>and Bioengineering Fundamentals (B2)</td>
<td>1</td>
</tr>
<tr>
<td>BOT 121</td>
<td>General Botany (B2)</td>
<td>1</td>
</tr>
<tr>
<td>MCRO 221</td>
<td>Microbiology (B2)</td>
<td>1</td>
</tr>
<tr>
<td>MCRO 224</td>
<td>General Microbiology I (B2)</td>
<td>1</td>
</tr>
</tbody>
</table>

Mathematics/Statistics Support Elective

Select from the following: 4

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 241</td>
<td>Calculus IV</td>
<td>4</td>
</tr>
<tr>
<td>MATH 248</td>
<td>Methods of Proof in Mathematics</td>
<td></td>
</tr>
<tr>
<td>MATH 306</td>
<td>Linear Algebra II</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 437</td>
<td>Game Theory</td>
<td></td>
</tr>
<tr>
<td>MATH 470</td>
<td>Selected Advanced Topics</td>
<td></td>
</tr>
<tr>
<td>STAT 313</td>
<td>Applied Experimental Design and Regression Models</td>
<td></td>
</tr>
<tr>
<td>STAT 323</td>
<td>Design and Analysis of Experiments I</td>
<td></td>
</tr>
<tr>
<td>STAT 324</td>
<td>Applied Regression Analysis</td>
<td></td>
</tr>
<tr>
<td>STAT 330</td>
<td>Statistical Computing with SAS</td>
<td></td>
</tr>
<tr>
<td>STAT 331</td>
<td>Statistical Computing with R</td>
<td></td>
</tr>
<tr>
<td>STAT 416</td>
<td>Statistical Analysis of Time Series</td>
<td></td>
</tr>
<tr>
<td>STAT 418</td>
<td>Categorical Data Analysis</td>
<td></td>
</tr>
<tr>
<td>STAT 419</td>
<td>Applied Multivariate Statistics</td>
<td></td>
</tr>
</tbody>
</table>
Physical Science Support Elective
Select one sequence from the following: 12

CHEM 124 & CHEM 125 & CHEM 126
General Chemistry for Physical Science and Engineering I and General Chemistry for Physical Science and Engineering II and General Chemistry for Physical Science and Engineering III (B3, B4) 1

PHYS 141 & PHYS 132 & PHYS 133
General Physics IA and General Physics II and General Physics III (B3, B4) 1

Additional Science Support Elective 5
Select from the following: 4-5

BIO 111
General Biology (B2)

BIO 161
Introduction to Cell and Molecular Biology (B2)

BOT 121
General Botany (B2)

CHEM 124
General Chemistry for Physical Science and Engineering I (B3)

MCRO 221
Microbiology (B2)

MCRO 224
General Microbiology I (B2)

PHYS 141
General Physics IA (B3)

Upper-division Elective
Select any upper-division course(s) 4

GENERAL EDUCATION (GE)
(See list of GE program requirements below.) 40

FREE ELECTIVES 0

Total units 180-181

1 Required in Support; also satisfies GE.

2 An additional 4 units of CPE/CSC technical electives may substitute for CPE/CSC 123, although new students are strongly encouraged to take CPE/CSC 123.

3 CSC 309 counts as Technical Elective. Students in the Interactive Entertainment Concentration are advised to take CSC 307 instead of CSC 308 and CSC 309.

4 Consultation with advisor is recommended prior to selecting technical electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

5 An additional 4 units of CPE/CSC technical electives is needed if CSC 123 is not taken.

6 No double counting is allowed between Additional Science Support Elective and Life Science Support Elective or Physical Science Support Elective.

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.

Select Technical Electives from the following: 1

CSC 301 Personal Software Process

CSC 305 Individual Software Design and Development

CSC 309 Software Engineering II

CSC 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 402 Software Requirements Engineering

CSC 405 Software Construction

CSC 406 Software Deployment

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 435 Introduction to Object Oriented Design Using Graphical User Interfaces

CSC 436 Mobile Application Development

CSC 437 Web Development

CSC 448 Bioinformatics Algorithms

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 484 Human-Computer Interaction Theory and Design

CSC 470 Knowledge Based Systems

CSC 488 User-Centered Interface Design and Development

CSC 489 Current Topics in Artificial Intelligence

CSC 490 Selected Advanced Topics

CSC 496 Selected Advanced Laboratory
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 400: Special Problems for Undergraduates
CPE 416: Autonomous Mobile Robotics
CPE 419: Applied Parallel Computing
CPE 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: Microelectronics and Electronics Packaging
DATA 301: Introduction to Data Science

The following restrictions must be satisfied.
4 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 402: Software Requirements Engineering
CSC 405: Software Construction
CSC 406: Software Deployment
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 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 484: User-Centered Interface Design and Development
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
AER 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

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:
AER 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
### Concentration

**Interactive Entertainment**

See the complete GE course listing (http://catalog.calpoly.edu/generalrequirementsbachelorsdegree/#generaleducationtext).

- Minimum of 8 units required at the 300 level.

### General Education (GE) Requirements

- 72 units required, 32 of which are specified in Major and/or Support.

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

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

Additional Area B units (8 units in Support)

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

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

Total units 40

1 Required in Support; also satisfies GE.