# 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.

## 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</th>
<th>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>
</tbody>
</table>
| Select from the following: &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&n...
Physical Science Support Elective
Select one sequence from the following: 12

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

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

Additional Science Support Elective 6
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 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 490 Selected Advanced Topics
CSC 496 Selected Advanced Laboratory
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>CSC 508</td>
<td>Software Engineering I</td>
</tr>
<tr>
<td>CSC 509</td>
<td>Software Engineering II</td>
</tr>
<tr>
<td>CSC/CPE 515</td>
<td>Computer Architecture</td>
</tr>
<tr>
<td>CSC 521</td>
<td>Computer Security</td>
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<tr>
<td>CSC 530</td>
<td>Languages and Translators</td>
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<tr>
<td>CSC 540</td>
<td>Theory of Computation II</td>
</tr>
<tr>
<td>CSC 550</td>
<td>Operating Systems</td>
</tr>
<tr>
<td>CSC 560</td>
<td>Database Systems</td>
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<tr>
<td>CSC/CPE 564</td>
<td>Computer Networks: Research Topics</td>
</tr>
<tr>
<td>CSC 566</td>
<td>Topics in Advanced Data Mining</td>
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<tr>
<td>CSC/CPE 569</td>
<td>Distributed Computing</td>
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<tr>
<td>CSC 570</td>
<td>Current Topics in Computer Science</td>
</tr>
<tr>
<td>CSC 572</td>
<td>Computer Graphics</td>
</tr>
<tr>
<td>CSC 580</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td>CSC 581</td>
<td>Computer Support for Knowledge Management</td>
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<tr>
<td>CSC 582</td>
<td>Introduction to Natural Language Processing</td>
</tr>
<tr>
<td>CPE 400</td>
<td>Special Problems for Undergraduates</td>
</tr>
<tr>
<td>CPE 416</td>
<td>Autonomous Mobile Robotics</td>
</tr>
<tr>
<td>CPE 419</td>
<td>Applied Parallel Computing</td>
</tr>
<tr>
<td>CPE 428</td>
<td>Computer Vision</td>
</tr>
<tr>
<td>CPE 464</td>
<td>Introduction to Computer Networks</td>
</tr>
<tr>
<td>CPE 465</td>
<td>Advanced Computer Networks</td>
</tr>
<tr>
<td>CPE 482</td>
<td>Advanced Topics in Systems for Computer Engineering</td>
</tr>
<tr>
<td>CPE 485</td>
<td>Autonomous Robot Navigation</td>
</tr>
<tr>
<td>CPE 488</td>
<td>Microelectronics and Electronics Packaging</td>
</tr>
<tr>
<td>DATA 301</td>
<td>Introduction to Data Science</td>
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</tbody>
</table>

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 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

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 and Electric Circuits Laboratory
& EE 251
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 314 Engineering Economics
IME 356 Manufacturing Automation
MATH 241 Calculus IV
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 24

1 A total of 24 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 is needed if CSC 123 is not taken.

Concentration
Interactive Entertainment (http://catalog.calpoly.edu/collegesandprograms/collegeofengineering/computersciencesoftwareengineering/bscomputerscience/interactiveentertainmentconcentration)

General Education (GE) Requirements
• 72 units required, 32 of which are specified in Major and/or Support.