BS SOFTWARE ENGINEERING

Program Learning Outcomes

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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		
CSC/CPE 101	Fundamentals of Computer Science	4
CSC/CPE 202	Data Structures	4
CSC/CPE 123	Introduction to Computing [1]	4
CSC/CPE 203	Project-Based Object-Oriented Programming and Design	4
CSC 225	Introduction to Computer Organization	4
CSC 248	Discrete Structures	4
CSC 300	Professional Responsibilities	4
or PHIL 323	Ethics, Science and Technology	
CSC 305	Individual Software Design and Development	4
CSC 308	Software Engineering I	4
CSC 309	Software Engineering II	4
CSC 349	Design and Analysis of Algorithms	4
CSC/CPE 357	Systems Programming	4
CSC 365	Introduction to Database Systems	4
CSC 402	Software Requirements Engineering	4
CSC 405	Software Construction	4
CSC 406	Senior Project - Software Deployment	4
CSC 430	Programming Languages	4
CSC 484	User-Centered Interface Design and Development	4
Technical Electives		
Select from the lists in Technical Electives Guidelines below [2,3]		16
SUPPORT COURSES		
IME 314	Engineering Economics	3
or IME 315	Financial Decision Making for Engineers	
MATH 141	Calculus I (B4) [4]	4
MATH 142	Calculus II (B4) [4]	4
MATH 143	Calculus III (Area B Electives) [4]	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
PHIL 230	Philosophical Classics: Knowledge and Reality (C2) [4]	4
or PHIL 231	Philosophical Classics: Ethics and Political Philosophy	
PSY 201/202	General Psychology (E) [4]	4
PSY 350	Teamwork	4
or COMS 217	Small Group Communication	
STAT 312	Statistical Methods for Engineers (Upper-Division B) [4]	4
Life Science Support Elective		
Select from the following (B2): [4]		4-5
BIO 111	General Biology	
BIO 161	Introduction to Cell and Molecular Biology	
BIO 213 & BMED 213	Life Science for Engineers and Bioengineering Fundamentals	
BOT 121	General Botany	
MCRO 221	Microbiology	
MCRO 224	General Microbiology I	
Mathematics Support Elective		
Select from the following:		4
MATH 248	Methods of Proof in Mathematics	
MATH 335	Graph Theory	
MATH 336	Combinatorial Math	
MATH 451	Numerical Analysis I	
Physical Science Support Electives		
Select one of the following series (B1 & B3; Area B Electives): [4]		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	
PHYS 141 & PHYS 132 & PHYS 133	General Physics IA and General Physics II and General Physics III	

GENERAL EDUCATION (GE)	
(See GE program requirements below.)	36
FREE ELECTIVES	
Free Electives [5]	0
Total units	**183-184**

1. An additional 4 units of CPE/CSC technical electives may substitute for CSC/CPE 123, although new students are strongly encouraged to take CSC/CPE 123.
2. 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.
3. An additional 4 units of CPE/CSC Technical Electives is needed if CSC/CPE 123 is not taken.
4. Required in Major or Support; also satisfies General Education (GE) requirement.
5. If a General Education (GE) course is used to satisfy a Major or Support requirement, additional units of Free Electives may be needed to complete the total units required for the degree.

Technical Electives Guidelines

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

Contact the Computer Science and Software Engineering department for further information.

Select Technical Electives from the following: [1,2]

CSC 313	Teaching Computing
CSC/CPE 321	Introduction to Computer Security
CSC 323	Cryptography Engineering
CSC 325	Introduction to Privacy: Policy and Technology
CSC 344	Music Programming
CSC 366	Database Modeling, Design and Implementation
CSC 369	Introduction to Distributed Computing
CSC 371	Game Design
CSC 377	Introduction to Mixed Reality
CSC 378	Interactive Entertainment Engineering
CSC 400	Special Problems [2]
CSC 409	Current Topics in Software Engineering
CSC 422	Network Security
CSC 424	Software Security
CSC/CPE 425	Wireless Security
CSC 429	Current Topics in Computer Security
CSC/CPE 431	Compiler Construction
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 469	Distributed Systems
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 482	Speech and Language Processing
CSC 486	Human-Computer Interaction Theory and Design
CSC 487	Deep Learning
CSC 490	Selected Advanced Topics [2]
CSC 496	Selected Advanced Laboratory [2]
CSC 497 & CSC 498	Research Senior Project I and Research Senior Project II
CSC 508	Software Engineering I
CSC 509	Software Engineering II
CSC/CPE 515	Computer Architecture
CSC 521	Computer Security
CSC 524	System Security
CSC 530	Languages and Translators
CSC 540	Theory of Computation II
CSC 549	Advanced Algorithm Design and Analysis
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	Computational Linguistics
CPE 315	Computer Architecture
CPE 400	Special Problems for Undergraduates [2]
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 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) 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 422	Network Security
CSC 424	Software Security
CSC/CPE 425	Wireless Security
CSC 429	Current Topics in Computer Security
CSC/CPE 431	Compiler Construction
CSC 437	Dynamic Web Development
CSC 448	Bioinformatics Algorithms
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 482	Speech and Language Processing
CSC 486	Human-Computer Interaction Theory and Design
CSC 487	Deep Learning
CSC 497 & CSC 498	Research Senior Project I and Research Senior Project II
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 549	Advanced Algorithm Design and Analysis
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	Computational Linguistics
CPE 416	Autonomous Mobile Robotics
CPE 465	Advanced Computer Networks
Up to 4 units may be taken from the Approved External Electives listed below:	
AERO 450	Introduction to Aerospace Systems Engineering
ART 376	The Art of Mixed Reality
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 & EE 251	Electric Circuit Theory 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 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 357	Cognition
STAT 305	Introduction to Probability and Simulation
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 334	Applied Linear Models
STAT 416	Statistical Analysis of Time Series

STAT 418	Categorical Data Analysis	
STAT 419	Applied Multivariate Statistics	
STAT 434	Statistical Learning: Methods and Applications	
Total units		**16**

1 A total of 16 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/CPE 123 is not taken.

2 Up to a combined 4 units may be taken from CSC 400, CPE 400, CSC 490, or CSC 496.

General Education (GE) Requirements

- 72 units required, 36 of which are specified in Major and/or Support.
- If any of the remaining 36 units is used to satisfy a Major or Support requirement, additional units of Free Electives may be needed to complete the total units required for the degree.
- See the complete GE course listing (http://catalog.calpoly.edu/generalrequirementsbachelorsdegree/#generaleducationtext).
- A grade of C- or better is required in one course in each of the following GE Areas: A1 (Oral Communication), A2 (Written Communication), A3 (Critical Thinking), and B4 (Mathematics/Quantitative Reasoning).

Area A	**English Language Communication and Critical Thinking**	
A1	Oral Communication	4
A2	Written Communication	4
A3	Critical Thinking	4
Area B	**Scientific Inquiry and Quantitative Reasoning**	
B1	Physical Science (4 units in Support) [1]	0
B2	Life Science (4 units in Support) [1]	0
B3	One lab taken with either a B1 or B2 course	
B4	Mathematics/Quantitative Reasoning (8 units in Support) [1]	0
Upper-Division B (4 units in Support) [1]		0
Area B Electives (8 units in Support) [1]		0
Area C	**Arts and Humanities**	
Lower-division courses in Area C must come from three different subject prefixes.		
C1	Arts: Arts, Cinema, Dance, Music, Theater	4
C2	Humanities: Literature, Philosophy, Languages other than English (4 units in Support) [1]	0
Lower-Division C Elective - Select a course from either C1 or C2.		4
Upper-Division C		4
Area D	**Social Sciences**	
D1	American Institutions (Title 5, Section 40404 Requirement)	4
Area D Elective - Select either a lower-division D2 or upper-division D course.		4
Area E	**Lifelong Learning and Self-Development**	
Lower-Division E (4 units in Support) [1]		0
Area F	**Ethnic Studies**	
Lower-Division F		4
Total units		**36**

1 Required in Major or Support; also satisfies General Education (GE) requirement.