BS COMPUTER ENGINEERING

Program Learning Outcomes

In addition to the general abilities expected of College of Engineering graduates, computer engineering students are expected to graduate with:

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.

In addition to the general abilities expected of College of Engineering graduates, computer engineering students are expected to graduate with:

- Knowledge of probability and statistics, including applications appropriate to CPE program objectives.
- Knowledge of mathematics through differential and integral calculus, basic sciences, and engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components, as appropriate to CPE program objectives.
- Knowledge of advanced mathematics, typically including differential equations, linear algebra, complex variables, and discrete mathematics.

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>CPE 100</td>
<td>Computer Engineering Orientation</td>
<td>1</td>
</tr>
<tr>
<td>CPE/CSC 101</td>
<td>Fundamentals of Computer Science</td>
<td>4</td>
</tr>
<tr>
<td>CPE/CSC 123</td>
<td>Introduction to Computing</td>
<td>4</td>
</tr>
</tbody>
</table>

CPE/EE 133 Digital Design 4
CPE/CSC 202 Data Structures 4
CPE/CSC 203 Project-Based Object-Oriented Programming and Design 4
CPE/EE 233 Computer Design and Assembly Language Programming 4
CPE 315 Computer Architecture 4 or CPE 333 Computer Hardware Architecture and Design 4
CPE/EE 329 Microcontroller-Based Systems Design 4 or CPE 316 Microcontrollers and Embedded Applications 4 or EE 336 Microprocessor System Design 4
CPE/CSC 357 Systems Programming 4
CPE 350 Capstone I 2 4
CPE 450 Capstone II 2 3
CPE/CSC 453 Introduction to Operating Systems 4
Select from the following: 3-4 5
CPE 461 Senior Project I & CPE 462 and Senior Project II
or
CSC 497 Research Senior Project I & CSC 498 and Research Senior Project II
CPE 464 Introduction to Computer Networks 4
CSC 248 Discrete Structures 4
EE 211 Electric Circuit Analysis II & EE 241 and Electric Circuit Analysis Laboratory II
Select from the following: 4-6
EE 112 Electric Circuit Analysis I & IME 156 and Basic Electronics Manufacturing
EE 112 Electric Circuit Analysis I & IME 458 and Microelectronics and Electronics Packaging
EE 113 Electric Circuit Analysis I & EE 143 and Electronics Manufacturing and Circuit Analysis Laboratory
EE 212 Electric Circuit Analysis III & EE 242 and Electric Circuit Analysis Laboratory III
Select from the following: 3
EE 228 Continuous-Time Signals and Systems
CPE 327 Digital Signals and Systems and Digital Signals and Systems Laboratory
& CPE 367
EE 306 Semiconductor Device Electronics and Semiconductor Device Electronics Laboratory & EE 346
EE 307 Digital Electronics and Integrated Circuits & EE 347
Any 300-500 level CPE Course
Any 300-500 level CSC or EE Course

Technical Electives 4,5,6
Select from the following:

- Any 300-500 level CPE Course
- Any 300-500 level CSC or EE Course
CPE 400 Special Problems for Undergraduates (up to 4 units)

Up to four units from the following:
- BMED 432 Micro/Nano System Design
- BMED 434/EE 423/MATE 430 Micro/Nano Fabrication
- BMED/MATE 435 Microfabrication Laboratory
- CHEM 312 Survey of Organic Chemistry
- CSC 300 Professional Responsibilities
- CPE 488/IME 458/MATE 458 Microelectronics and Electronics Packaging

DATA 301 Introduction to Data Science
- IME 301 Operations Research I
- IME 303 Project Organization and Management
- IME 314 Engineering Economics or IME 315 Financial Decision Making for Engineers
- IME 319 Human Factors Engineering
- IME 401 Sales Engineering
- IME 457 Advanced Electronic Manufacturing
- MATH 304 Vector Analysis
- MATH 408 Complex Analysis I
- MATH 409 Complex Analysis II
- MATH 451 Numerical Analysis I
- ME 405 Mechatronics
- PHYS 322 Vibrations and Waves
- PHYS 323 Optics
- PHYS 408 Electromagnetic Fields and Waves I
- PHYS 412 Solid State Physics
- PHYS 452 Solid State Physics Laboratory

SUPPORT COURSES
- CHEM 124 General Chemistry for Physical Science and Engineering I (B1 & B3)
- CHEM 224 General Chemistry for Physical Science and Engineering II
- CHEM 312 Survey of Organic Chemistry
- CHEM 313 Survey of Inorganic Chemistry
- CHEM 320 Organic Chemistry I
- CHEM 321 Organic Chemistry II
- CHEM 330 Biochemistry
- CHEM 331 Physical Chemistry
- CHEM 340 Environmental Chemistry
- CHEM 341 Analytical Chemistry
- CHEM 350 Quantum Chemistry
- CHEM 360 Inorganic Chemistry
- CHEM 370 Physical Chemistry
- CHEM 380 Organic Chemistry
- CHEM 390 Physical Chemistry
- CHEM 400 Physical Chemistry
- CHEM 410 Physical Chemistry
- CHEM 420 Physical Chemistry
- CHEM 430 Physical Chemistry
- CHEM 440 Physical Chemistry
- CHEM 450 Physical Chemistry
- CHEM 460 Physical Chemistry
- CHEM 470 Physical Chemistry
- CHEM 480 Physical Chemistry
- CHEM 490 Physical Chemistry
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- CHEM 520 Physical Chemistry
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- CHEM 620 Physical Chemistry
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- CHEM 670 Physical Chemistry
- CHEM 680 Physical Chemistry
- CHEM 690 Physical Chemistry
- CHEM 700 Physical Chemistry
- CHEM 710 Physical Chemistry
- CHEM 720 Physical Chemistry
- CHEM 730 Physical Chemistry
- CHEM 740 Physical Chemistry
- CHEM 750 Physical Chemistry
- CHEM 760 Physical Chemistry
- CHEM 770 Physical Chemistry
- CHEM 780 Physical Chemistry
- CHEM 790 Physical Chemistry
- CHEM 800 Physical Chemistry
- CHEM 810 Physical Chemistry
- CHEM 820 Physical Chemistry
- CHEM 830 Physical Chemistry
- CHEM 840 Physical Chemistry
- CHEM 850 Physical Chemistry
- CHEM 860 Physical Chemistry
- CHEM 870 Physical Chemistry
- CHEM 880 Physical Chemistry
- CHEM 890 Physical Chemistry
- CHEM 900 Physical Chemistry
- CHEM 910 Physical Chemistry
- CHEM 920 Physical Chemistry
- CHEM 930 Physical Chemistry
- CHEM 940 Physical Chemistry
- CHEM 950 Physical Chemistry
- CHEM 960 Physical Chemistry
- CHEM 970 Physical Chemistry
- CHEM 980 Physical Chemistry
- CHEM 990 Physical Chemistry

Approved CSC, EE, Math, or Science Elective

Select from the following:
- CHEM 125 General Chemistry for Physical Science and Engineering II
- CPE/EE 328 Discrete Time Signals and Systems
- CSC 349 Design and Analysis of Algorithms

MATE 210 Materials Engineering
& MATE 215 and Materials Laboratory I (both needed)

ME 211 Engineering Statics

MATH 141 Calculus I (B4)
MATH 142 Calculus II (B4)
MATH 143 Calculus III (Area B Electives)
MATH 241 Calculus IV
MATH 244 Linear Analysis I

PHYS 141 General Physics IA (Area B Electives)

PHYS 132 General Physics II
PHYS 133 General Physics III
PHYS 211 Modern Physics I

STAT 350 Probability and Random Processes for Engineers (Upper-Division B)

GENERAL EDUCATION (GE)

(See GE program requirements below.)

FREE ELECTIVES

Free Electives

Total units: 191-195

1. An additional 4 units of Technical Electives may be substituted, although new students are strongly encouraged to take CSC 123/CPE 123.
2. ENGR 459, ENGR 460, ENGR 461, and CPE 400 (7) or ENGR 463, ENGR 464, ENGR 465, and CPE 400 (7) may substitute for CPE 350 and CPE 450 (7).
3. When choosing this option, ensure compliance with the "60 units of upper-division" requirement.
4. Consultation with an advisor is recommended prior to selecting Approved or Technical Electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
5. The following courses may not be used to satisfy this requirement: COOP units; BUS 499; CSC 320, CSC 400, CSC 500; EE 321, EE 322, EE 361, EE 400, EE 460, EE 500, EE 563.
6. Required in Major or Support, also satisfies General Education (GE) requirement.

General Education (GE) Requirements

- 72 units required, 32 of which are specified in Major and/or Support.
- If any of the remaining 40 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
<table>
<thead>
<tr>
<th>Area</th>
<th>Requirement</th>
<th>Units</th>
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<tbody>
<tr>
<td>A2</td>
<td>Written Communication</td>
<td>4</td>
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<tr>
<td>A3</td>
<td>Critical Thinking</td>
<td>4</td>
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<tr>
<td>Area B</td>
<td>Scientific Inquiry and Quantitative Reasoning</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>Physical Science (4 units in Support)</td>
<td>0</td>
</tr>
<tr>
<td>B2</td>
<td>Life Science</td>
<td>4</td>
</tr>
<tr>
<td>B3</td>
<td>One lab taken with either a B1 or B2 course</td>
<td></td>
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<tr>
<td>B4</td>
<td>Mathematics/Quantitative Reasoning (8 units in Support)</td>
<td>0</td>
</tr>
<tr>
<td>Upper-Division B (4 units in Support)</td>
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</tr>
<tr>
<td>Area B Electives (8 units in Support)</td>
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</tr>
<tr>
<td>Area C</td>
<td>Arts and Humanities</td>
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</tr>
<tr>
<td>C1</td>
<td>Arts: Arts, Cinema, Dance, Music, Theater</td>
<td>4</td>
</tr>
<tr>
<td>C2</td>
<td>Humanities: Literature, Philosophy, Languages other than English (4 units in Support)</td>
<td>0</td>
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<tr>
<td>Lower-Division C Elective - Select a course from either C1 or C2.</td>
<td>4</td>
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<tr>
<td>Upper-Division C (4 units in Support)</td>
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<tr>
<td>Area D</td>
<td>Social Sciences</td>
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</tr>
<tr>
<td>D1</td>
<td>American Institutions (Title 5, Section 40404 Requirement)</td>
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<tr>
<td>Area D Elective - Select either a lower-division D2 or upper-division D course.</td>
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<tr>
<td>Area E</td>
<td>Lifelong Learning and Self-Development</td>
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<tr>
<td>Lower-Division E</td>
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<tr>
<td>Area F</td>
<td>Ethnic Studies</td>
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<td>Lower-Division F</td>
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<tr>
<td>Total units</td>
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</table>

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