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>
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</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: 4-5

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>CPE 461 &amp; CPE 462</td>
<td>Senior Project I and Senior Project II</td>
<td>4-5</td>
</tr>
<tr>
<td>CSC 497 &amp; CSC 498</td>
<td>Research Senior Project I and Research Senior Project II</td>
<td>4-5</td>
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</tbody>
</table>
| CPE 464 | Introduction to Computer Networks | 4
| CSC 348 | Discrete Structures | 4
| EE 211 & EE 241 | Electric Circuit Analysis II and Electric Circuit Analysis Laboratory II | 4

Select from the following: 4-6

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
</table>
| EE 112 & IME 156 | Electric Circuit Analysis I and Basic Electronics Manufacturing | 4
| EE 112 & IME 458 | Electric Circuit Analysis I and Microelectronics and Electronics Packaging | 4
| EE 113 & EE 143 | Electric Circuit Analysis I and Electronics Manufacturing and Circuit Analysis Laboratory | 4
| EE 212 & EE 242 | Electric Circuit Analysis III and Electric Circuit Analysis Laboratory III | 4
| EE 228 | Continuous-Time Signals and Systems | 4
| or CPE 327 & CPE 367 | Digital Signals and Systems and Digital Signals and Systems Laboratory | 4
| EE 306 & EE 346 | Semiconductor Device Electronics and Semiconductor Device Electronics Laboratory | 4
| EE 307 & EE 347 | Digital Electronics and Integrated Circuits and Digital Electronics and Integrated Circuits Laboratory | 4

Technical Electives ³,⁴,⁵

Select from the following: 12

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any 300-500 level CPE Course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any 300-500 level CSC or EE Course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPE 400</td>
<td>Special Problems for Undergraduates (up to 4 units)</td>
<td></td>
</tr>
</tbody>
</table>

³ Select from the following:
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
</table>
| CPE/CSC 357 | 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

² or CPE 350 & CPE 450

³ or CPE 306 & CPE 346

⁴ or CPE 307 & CPE 347

⁵ or CPE 400
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
- UNIV/HNRS 424 Design of Museum Displays of Science, Engineering and Technology

**SUPPORT COURSES**

- CHEM 124 General Chemistry for Physical Science and Engineering I (B1 & B3) 6

**Approved CSC, EE, Math, or Science Elective**

Select from the following: 3-4

- 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
- ENGL 149 Technical Writing for Engineers (A3) 6
- MATH 141 Calculus I (B4) 6
- MATH 142 Calculus II (B4) 6
- MATH 143 Calculus III (Area B Electives) 6
- MATH 241 Calculus IV
- MATH 244 Linear Analysis I
- PHYS 141 General Physics IA (Area B Electives) 6
- 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) 6

**GENERAL EDUCATION (GE)**

(See GE program requirements below.)

**FREE ELECTIVES**

Free Electives 0

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. 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.
4. Courses taken to meet the Technical Electives requirement cannot be double-counted to satisfy another Major or Support requirement.
5. The following courses may not be used to satisfy this requirement: COOP units; BUS 499; CSC 302, CSC 303, CSC 310, 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, 28 of which are specified in Major and/or Support.
- If any of the remaining 44 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 units in Support) 1 0

**Area B**

**Scientific Inquiry and Quantitative Reasoning**

- B1 Physical Science (4 units in Support) 1 0
- B2 Life Science 4
- 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**

**Area B Electives (8 units in Support) 1**

**Area C**

**Arts and Humanities**
Lower-division courses in Area C must come from three different subject prefixes.

<table>
<thead>
<tr>
<th>C1</th>
<th>Arts: Arts, Cinema, Dance, Music, Theater</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>Humanities: Literature, Philosophy, Languages other than English</td>
<td>4</td>
</tr>
<tr>
<td>Lower-Division C Elective - Select a course from either C1 or C2.</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Upper-Division C</td>
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<td>4</td>
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</table>

**Area D**  
**Social Sciences**

<table>
<thead>
<tr>
<th>D1</th>
<th>American Institutions (Title 5, Section 40404 Requirement)</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>D2</td>
<td>Lower-Division D</td>
<td>4</td>
</tr>
<tr>
<td>Area D Elective - Select either a lower-division or upper-division course.</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**Area E**  
**Lifelong Learning and Self-Development**

<table>
<thead>
<tr>
<th>Lower-Division E</th>
<th></th>
<th>4</th>
</tr>
</thead>
</table>

Total units 44

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