BS BIOMEDICAL 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 objective
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

Furthermore, our program prepares graduates with experience in:

- Applying principles of engineering, biology, human physiology, chemistry, calculus-based physics, mathematics (through differential equations) and statistics
- Solving bio/biomedical engineering problems, including those associated with the interaction between living and non-living systems
- Analyzing, modeling, designing, and realizing bio/biomedical engineering devices, systems, components, or processes
- Making measurements on and interpreting data from living systems

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 (https://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>BMED 101</td>
<td>Introduction to the Biomedical Engineering Major</td>
<td>1</td>
</tr>
<tr>
<td>BMED 102</td>
<td>Introduction to Biomedical Engineering Analysis</td>
<td>1</td>
</tr>
<tr>
<td>BMED 212</td>
<td>Introduction to Biomedical Engineering Design</td>
<td>3</td>
</tr>
<tr>
<td>BMED 310</td>
<td>Biomedical Engineering Measurement and Analysis</td>
<td>4</td>
</tr>
<tr>
<td>BMED 410</td>
<td>Biomechanics</td>
<td>4</td>
</tr>
<tr>
<td>BMED 420</td>
<td>Principles of Biomaterials Design</td>
<td>4</td>
</tr>
<tr>
<td>BMED 425</td>
<td>Biomedical Engineering Transport</td>
<td>4</td>
</tr>
<tr>
<td>BMED 430</td>
<td>Biomedical Modeling and Simulation</td>
<td>2</td>
</tr>
<tr>
<td>BMED 440</td>
<td>Bioelectronics and Instrumentation</td>
<td>4</td>
</tr>
<tr>
<td>BMED 450</td>
<td>Contemporary Issues in Biomedical Engineering</td>
<td>4</td>
</tr>
<tr>
<td>BMED 455</td>
<td>Biomedical Engineering Design I</td>
<td>4</td>
</tr>
<tr>
<td>BMED 456</td>
<td>Biomedical Engineering Design II: Senior Project</td>
<td>4</td>
</tr>
<tr>
<td>BMED 460</td>
<td>Engineering Physiology</td>
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General Curriculum in BS Biomedical Engineering or Concentration 28-33

SUPPORT COURSES

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 161</td>
<td>Introduction to Cell and Molecular Biology (B2 &amp; B3)</td>
<td>2</td>
</tr>
<tr>
<td>BIO 231</td>
<td>Human Anatomy and Physiology I or BIO 232</td>
<td>5</td>
</tr>
<tr>
<td>CE 204</td>
<td>Mechanics of Materials I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 124</td>
<td>General Chemistry for Physical Science and Engineering I (B1)</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 125</td>
<td>General Chemistry for Physical Science and Engineering II</td>
<td>4</td>
</tr>
<tr>
<td>CSC 231</td>
<td>Programming for Engineering Students</td>
<td>2</td>
</tr>
<tr>
<td>EE 201</td>
<td>Electric Circuit Theory</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 147</td>
<td>Writing Arguments about STEM (A3)</td>
<td>2</td>
</tr>
<tr>
<td>MATE 210</td>
<td>Materials Engineering</td>
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</tr>
<tr>
<td>MATH 141</td>
<td>Calculus I (B4)</td>
<td>2</td>
</tr>
<tr>
<td>MATH 142</td>
<td>Calculus II (B4)</td>
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</tr>
<tr>
<td>MATH 143</td>
<td>Calculus III (Area B Electives)</td>
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<tr>
<td>MATH 241</td>
<td>Calculus IV</td>
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<tr>
<td>MATH 244</td>
<td>Linear Analysis I</td>
<td>4</td>
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<tr>
<td>ME 211</td>
<td>Engineering Statics</td>
<td>3</td>
</tr>
<tr>
<td>ME 212</td>
<td>Engineering Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 302</td>
<td>Thermodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>ME 341</td>
<td>Fluid Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 141</td>
<td>General Physics I (Area B Electives)</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 142</td>
<td>General Physics II</td>
<td>4</td>
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<tr>
<td>PHYS 143</td>
<td>General Physics III</td>
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</tr>
<tr>
<td>STAT 312</td>
<td>Statistical Methods for Engineers (Upper-Division B)</td>
<td>2</td>
</tr>
</tbody>
</table>

GENERAL EDUCATION (GE)

(See GE program requirements below.) 40

FREE ELECTIVES

Free Electives 0

Total units 191-196

1. ENGR 459, ENGR 460, ENGR 461 and BMED 400 (8); or ENGR 463, ENGR 464, ENGR 465, and BMED 400 (8) may substitute for BMED 455 and BMED 456 (8).
Required in Major or Support; also satisfies General Education (GE) requirement.

For students following the General Curriculum or Mechanical Design Concentration in BS Biomedical Engineering, CE 208 (5) may substitute for both CE 204 (3) and CE 207 (2).

General Curriculum in BS Biomedical Engineering or Concentrations

- General Curriculum (https://catalog.calpoly.edu/collegesandprograms/collegeofengineering/biomedicalengineering/bsbiomedicalengineering/generalcurriculum/)
- Bioinstrumentation (https://catalog.calpoly.edu/collegesandprograms/collegeofengineering/biomedicalengineering/bsbiomedicalengineering/bioinstrumentationconcentration/)
- Mechanical Design (https://catalog.calpoly.edu/collegesandprograms/collegeofengineering/biomedicalengineering/bsbiomedicalengineering/mechanicaldesignconcentration/)

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 (https://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).

<table>
<thead>
<tr>
<th>Area A</th>
<th>English Language Communication and Critical Thinking</th>
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</thead>
<tbody>
<tr>
<td>A1</td>
<td>Oral Communication</td>
</tr>
<tr>
<td>A2</td>
<td>Written Communication</td>
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<tr>
<td>A3</td>
<td>Critical Thinking (4 units in Support)</td>
</tr>
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<table>
<thead>
<tr>
<th>Area B</th>
<th>Scientific Inquiry and Quantitative Reasoning</th>
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</thead>
<tbody>
<tr>
<td>B1</td>
<td>Physical Science (4 units in Support)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>Life Science (4 units in Support)</td>
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<tr>
<td>B3</td>
<td>One lab taken with either a B1 or B2 course</td>
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<tr>
<td>B4</td>
<td>Mathematics/Quantitative Reasoning (8 units in Support)</td>
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<table>
<thead>
<tr>
<th>Area D</th>
<th>Social Sciences</th>
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<tbody>
<tr>
<td>D1</td>
<td>American Institutions (Title 5, Section 40404 Requirement)</td>
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<table>
<thead>
<tr>
<th>Area E</th>
<th>Lifelong Learning and Self-Development</th>
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<tbody>
<tr>
<td>Lower-Division E</td>
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<table>
<thead>
<tr>
<th>Area F</th>
<th>Ethnic Studies</th>
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<tbody>
<tr>
<td>F</td>
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</table>

| Total units     | 40                                                  |

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