BS MATERIALS 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
8. An ability to apply advanced science (such as Chemistry and Physics) and engineering principles to materials systems
9. An integrated understanding of scientific and engineering principles underlying the four major elements of the field: structure, properties, processing, and performance related to materials systems
10. An ability to apply and integrate knowledge from each of the above four elements of the field to solve materials selection and design problems
11. An ability to utilize experimental, statistical, and computational methods consistent with the goals of the program

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>
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<tbody>
<tr>
<td>MATE 110</td>
<td>Introduction to Materials Engineering Design I</td>
<td>1</td>
</tr>
<tr>
<td>MATE 120</td>
<td>Introduction to Materials Engineering Design II</td>
<td>1</td>
</tr>
<tr>
<td>MATE 130</td>
<td>Introduction to Materials Engineering Design III</td>
<td>1</td>
</tr>
<tr>
<td>MATE 210</td>
<td>Materials Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MATE 215</td>
<td>Materials Laboratory I</td>
<td>1</td>
</tr>
</tbody>
</table>

Technical Electives

Select from the following:

- BMED 420 Principles of Biomaterials Design
- BMED 434/ MATE 430 Micro/Nano Fabrication
- BMED/MATE 435 Microfabrication Laboratory
- BMED/MATE 530 Biomaterials
- CHEM 444 Polymers & Coatings I
- CHEM/MATE 446 Surface Chemistry of Materials
- CHEM 447 Polymers and Coatings Laboratory I
- CPE 488/ IME 458/MATE 458 Microelectronics and Electronics Packaging
- EE/PHYS 422 Polymer Electronics Laboratory
- ENVE 490 Environmental Nanotechnology
- MATE 400 Special Problems for Advanced Undergraduates
- MATE 401 Materials Characterization Techniques
- MATE 402 Materials Characterization Theory
- MATE 403 Computational Materials Analysis
- MATE 410 Nanoscale Engineering
- MATE 420 Biopolymers and Bionanocomposites
- MATE 422 Ceramics and Glasses
- MATE 425 Corrosion Engineering
- MATE 440 Welding Metallurgy and Joining of Advanced Materials
- MATE 445 Joining of Advanced Materials Laboratory
- MATE 450 Fracture and Failure Analysis
- MATE 456 Materials for Electrochemical Energy Storage
- MATE 460 Materials Selection in Mechanical Design
- MATE 465 Ferrous Metallurgy
- MATE 470 Selected Advanced Topics
- MATE 471 Selected Advanced Laboratory
- MATE 485 Materials and the Environment
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>MATE 490</td>
<td>Solidification and Densification</td>
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</tbody>
</table>
| MATE 500   | Individual Study  
| MATE 550   | Micro Systems  
or BMED 432  
| PHYS 412   | Solid State Physics  
| PHYS 413   | Advanced Topics in Solid State Physics  
|            | Approved Electives/Technical Breadth Electives  
Select from the following:  
| BIO 231 | Human Anatomy and Physiology I  
| BMED 310 | Biomedical Engineering Measurement and Analysis  
| BMED 401 | Biomedical Entrepreneurship  
| BMED 434/ MATE 430 | Micro/Nano Fabrication  
| BMED/MATE 435 | Microfabrication Laboratory  
| BMED/MATE 530 | Biomaterials  
| BMED 550 | Current and Evolving Topics in Biomedical Engineering  
| BUS 207 | Legal Responsibilities of Business  
| BUS 212 | Financial Accounting for Nonbusiness Majors  
| CE 207 | Mechanics of Materials II  
| CHEM 312 | Survey of Organic Chemistry  
| CHEM 444 | Polymers & Coatings I  
| CHEM/MATE 446 | Surface Chemistry of Materials  
| CHEM 447 | Polymers and Coatings Laboratory I  
| CHEM 466 | Learning Assistant Seminar  
| CPE 488/IME 458/MATE 458 | Microelectronics and Electronics Packaging  
| CSC 235 | Fundamentals of Computer Science for Scientists and Engineers I  
| EE/PHYS 422 | Polymer Electronics Laboratory  
| ECON 221 | Microeconomics  
| ENGR 322/SCM 302 | The Learn By Doing Lab Teaching Practicum  
| ENGR 470 | Selected Advanced Topics  
| ENGR 471 | Selected Advanced Laboratory  
| ENVE 490 | Environmental Nanotechnology  
| IME 223 | Process Improvement Fundamentals  
| IME 303 | Project Organization and Management  
| IME 421 | Manufacturing Organizations  
| ITP 341 | Packaging Polymers and Processing  
| MATE 400 | Special Problems for Advanced Undergraduates  
| MATE 401 | Materials Characterization Techniques  
| MATE 402 | Materials Characterization Theory  
| MATE 403 | Computational Materials Analysis  
| MATE 410 | Nanoscale Engineering  
| MATE 420 | Biopolymers and Bionanocomposites  
| MATE 422 | Ceramics and Glasses  
| MATE 425 | Corrosion Engineering  
| MATE 440 | Welding Metallurgy and Joining of Advanced Materials  
| MATE 445 | Joining of Advanced Materials Laboratory  
| MATE 450 | Fracture and Failure Analysis  
| MATE 456 | Materials for Electrochemical Energy Storage  
| MATE 460 | Materials Selection in Mechanical Design  
| MATE 465 | Ferrous Metallurgy  
| MATE 470 | Selected Advanced Topics  
| MATE 471 | Selected Advanced Laboratory  
| MATE 485 | Materials and the Environment  
| MATE 490 | Solidification and Densification  
| MATE 500 | Individual Study  
| MATE 550 | Micro Systems  
or BMED 432  
| MATE 570 | Selected Advanced Topics  
| MATE 571 | Selected Advanced Laboratory  
| ME 212 | Engineering Dynamics  
| ME 341 | Fluid Mechanics I  
| NR 434 | Wood Properties, Products and Sustainable Uses  
| PHYS 211 | Modern Physics I  
| PHYS 412 | Solid State Physics  
| PHYS 413 | Advanced Topics in Solid State Physics  
| PSC/UNIV 392 | Appropriate Technology for the World's People: Design  
| PSC/UNIV 492 | Appropriate Technology for the World's People: Design  
| UNIV 424 | Design of Museum Displays of Science, Engineering and Technology  
|            | SUPPORT COURSES  
| CE 204 | Mechanics of Materials I  
| CHEM 124 | General Chemistry for Physical Science and Engineering I (B1 & B3)  
| CHEM 125 | General Chemistry for Physical Science and Engineering II  
| IME 144 | Introduction to Design and Manufacturing  
| EE 201 | Electric Circuit Theory  
| EE 251 | Electric Circuits Laboratory  
| ENGL 149 | Technical Writing for Engineers (A3)  
| IME 144 | Introduction to Design and Manufacturing  
| IME 303 | Project Organization and Management  
| IME 421 | Manufacturing Organizations  
| ITP 341 | Packaging Polymers and Processing  
| 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  
| ME 211 | Engineering Statics  

Select from the following: 3-4
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 350</td>
<td>Heat Transfer</td>
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</tr>
<tr>
<td>MATE 325 &amp; MATE 326 &amp; MATE 327</td>
<td>Transport Phenomena I and Transport Phenomena II and Transport Phenomena III</td>
<td>5</td>
</tr>
<tr>
<td>PHYS 141</td>
<td>General Physics IA (Area B Electives)</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 132</td>
<td>General Physics II</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 133</td>
<td>General Physics III</td>
<td>4</td>
</tr>
<tr>
<td>Select from the following (Upper-Division B):</td>
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<td>7-8</td>
</tr>
<tr>
<td>STAT 312 &amp; IME 315</td>
<td>Statistical Methods for Engineers and Financial Decision Making for Engineers</td>
<td></td>
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<tr>
<td>or</td>
<td>STAT 321 &amp; IME 315</td>
<td>Probability and Statistics for Engineers and Financial Decision Making for Engineers</td>
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<tr>
<td>or</td>
<td>STAT 321 &amp; IME 326</td>
<td>Probability and Statistics for Engineers and Financial Decision Making for Engineers</td>
</tr>
</tbody>
</table>

**GENERAL EDUCATION**

(See GE program requirements below.) 44

**FREE ELECTIVES**

Free Electives 0

Total units 184-186

1. ENGR 459, ENGR 460 and ENGR 461 (6) may substitute for MATE 482, MATE 483 and MATE 484 (5) with the one excess unit counting towards Technical Electives.
2. If a course is taken to meet this requirement, it cannot be double-counted to satisfy another Major or Support requirement.
3. Consultation with an advisor is recommended prior to selecting Technical or Approved Electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
4. 8 units maximum of MATE 400 and/or MATE 500 may count towards Technical Electives or Approved Electives/Technical Breadth Electives.
5. If Support Course requirements are met with IME 315 and with MATE 325, MATE 326, MATE 327 (for a total of six units), at least one unit of upper-division coursework must be taken in Approved Electives/Technical Breadth Electives to meet the minimum requirement of 60 units of upper-division credit.
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

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<tr>
<td>A1</td>
<td>Oral Communication</td>
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<tr>
<td>A2</td>
<td>Written Communication</td>
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<tr>
<td>A3</td>
<td>Critical Thinking (4 units in Support)</td>
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**Area B**

Scientific Inquiry and Quantitative Reasoning

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<tbody>
<tr>
<td>B1</td>
<td>Physical Science (4 units in Support)</td>
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<tr>
<td>B2</td>
<td>Life Science</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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**Upper-Division B (4 units in Support) | 0

**Area C**

Arts and Humanities

Lower-division courses in Area C must come from three different subject prefixes.

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

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**Area D**

Social Sciences

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

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**Area E**

Lifelong Learning and Self-Development

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**Lower-Division E**

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Total units 44

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