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>
</tr>
</thead>
<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>
<tr>
<td>MATE 225</td>
<td>Materials Laboratory II</td>
<td>1</td>
</tr>
<tr>
<td>MATE 232</td>
<td>Materials, Ethics, and Society</td>
<td>4</td>
</tr>
<tr>
<td>MATE 235</td>
<td>Materials Laboratory III</td>
<td>1</td>
</tr>
<tr>
<td>MATE 280</td>
<td>Introduction to Materials</td>
<td>4</td>
</tr>
<tr>
<td>MATE 310</td>
<td>Noncrystalline Material Systems</td>
<td>4</td>
</tr>
<tr>
<td>MATE 320</td>
<td>Materials Selection for the Life Cycle</td>
<td>4</td>
</tr>
<tr>
<td>MATE 340</td>
<td>Electronic Materials Systems</td>
<td>4</td>
</tr>
<tr>
<td>MATE 350</td>
<td>Structural Materials Systems</td>
<td>4</td>
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<tr>
<td>MATE 360</td>
<td>Metallurgical Materials Systems</td>
<td>4</td>
</tr>
<tr>
<td>MATE 370</td>
<td>Kinetics of Materials and Process Design</td>
<td>4</td>
</tr>
<tr>
<td>MATE 480</td>
<td>Composite Materials Systems</td>
<td>4</td>
</tr>
<tr>
<td>MATE 482</td>
<td>Senior Project I</td>
<td>5</td>
</tr>
<tr>
<td>MATE 483</td>
<td>Senior Project II</td>
<td>5</td>
</tr>
<tr>
<td>MATE 484</td>
<td>Senior Project III</td>
<td>5</td>
</tr>
</tbody>
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**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
MATE 490  Solidification and Densification
MATE 500  Individual Study 3
MATE 550  Micro Systems
or BMED 432  Micro/Nano System Design
PHYS 412  Solid State Physics
PHYS 413  Advanced Topics in Solid State Physics

Approved Electives/Technical Breadth Electives
Select from the following: 2,3,5  8
BIO 231  Human Anatomy and Physiology I
BMED 310  Biomedical Engineering
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 4
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 4
MATE 550  Micro Systems
or BMED 432  Micro/Nano System Design
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 3
CHEM 124  General Chemistry for Physical Science and Engineering I (B1 & B3) 6
CHEM 125  General Chemistry for Physical Science and Engineering II 4
CSC 231  Programming for Engineering Students 2
EE 201  Electric Circuit Theory 3
EE 251  Electric Circuits Laboratory 1
ENGL 149  Technical Writing for Engineers (A3) 6
IME 144  Introduction to Design and Manufacturing 4
MATH 141  Calculus I (B4) 6 4
MATH 142  Calculus II (B4) 6 4
MATH 143  Calculus III (Area B Electives) 6 4
MATH 241  Calculus IV 4
MATH 244  Linear Analysis I 4
ME 211  Engineering Statics 3
Select from the following: 3-4
ME 350  Heat Transfer
MATE 325  Transport Phenomena I
& MATE 326  and Transport Phenomena II
& MATE 327  and Transport Phenomena III
PHYS 141  General Physics IA (Area B Electives) 6
PHYS 132  General Physics II
PHYS 133  General Physics III
Select from the following (Upper-Division B): 6
STAT 312  Statistical Methods for Engineers
& IME 315  and Financial Decision Making for Engineers
or
STAT 321  Probability and Statistics for Engineers and Scientists
& IME 315  and Financial Decision Making for Engineers
or
STAT 321  Probability and Statistics for Engineers and Scientists
& IME 326  and Engineering Test Design and Analysis

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**

| A1 | Oral Communication | 4 |
| A2 | Written Communication | 4 |
| A3 | Critical Thinking (4 units in Support) 1 | 0 |

**Area B**

| 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 | 0 |

**Area C**

| C1 | Arts: Arts, Cinema, Dance, Music, Theater | 4 |
| C2 | Humanities: Literature, Philosophy, Languages other than English | 4 |

**Lower-Division C Elective - Select a course from either C1 or C2.**

| Area D | Social Sciences |
| D1 | American Institutions (Title 5, Section 40404 Requirement) | 4 |
| D2 | Lower-Division D |
| Area D Elective - Select either a lower-division or upper-division course. | 4 |

**Area E**

| E | Lifelong Learning and Self-Development |
| Lower-Division E | 4 |

Total units  44

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