BS MANUFACTURING 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.

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
- 2.0 GPA
- Graduation Writing Requirements (GWR)
- 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>IME 101</td>
<td>Introduction to Industrial and Manufacturing Engineering</td>
<td>1</td>
</tr>
<tr>
<td>IME 140</td>
<td>Graphics Communication and Modeling</td>
<td>2</td>
</tr>
<tr>
<td>IME 141</td>
<td>Manufacturing Processes: Net Shape</td>
<td>1</td>
</tr>
<tr>
<td>IME 142</td>
<td>Manufacturing Processes: Materials Joining</td>
<td>2</td>
</tr>
<tr>
<td>IME 144</td>
<td>Introduction to Design and Manufacturing</td>
<td>4</td>
</tr>
<tr>
<td>IME 156</td>
<td>Basic Electronics Manufacturing</td>
<td>2</td>
</tr>
<tr>
<td>IME 223</td>
<td>Process Improvement Fundamentals</td>
<td>4</td>
</tr>
<tr>
<td>IME 314</td>
<td>Engineering Economics</td>
<td>3</td>
</tr>
<tr>
<td>IME 315</td>
<td>Financial Decision Making for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>IME 327</td>
<td>Test Design and Analysis in Manufacturing</td>
<td>4</td>
</tr>
<tr>
<td>IME 330</td>
<td>Fundamentals of Manufacturing Engineering</td>
<td>4</td>
</tr>
<tr>
<td>IME 335</td>
<td>Computer-Aided Manufacturing I</td>
<td>4</td>
</tr>
<tr>
<td>IME 342</td>
<td>Manufacturing Systems Integration</td>
<td>4</td>
</tr>
<tr>
<td>IME 356</td>
<td>Manufacturing Automation</td>
<td>4</td>
</tr>
<tr>
<td>IME 417</td>
<td>Supply Chain and Logistics Management</td>
<td>4</td>
</tr>
<tr>
<td>IME 418</td>
<td>Product-Process Design</td>
<td>4</td>
</tr>
<tr>
<td>IME 430</td>
<td>Quality Engineering</td>
<td>4</td>
</tr>
<tr>
<td>IME 450</td>
<td>Manufacturing Process and Tool Engineering</td>
<td>4</td>
</tr>
<tr>
<td>IME 481</td>
<td>Senior Design Project I</td>
<td>6</td>
</tr>
<tr>
<td>IME 482</td>
<td>Senior Design Project II</td>
<td>6</td>
</tr>
<tr>
<td>IME 483</td>
<td>Senior Design Project III</td>
<td>6</td>
</tr>
</tbody>
</table>

Technical Electives

Select from Category A (8-13 units) & Category B (0-5 units) below:

Category A

- BMED 410 Biomechanics
- EE 361 Electronics Laboratory
- EE 434 Automotive Engineering for a Sustainable Future
- IME 301 Operations Research I
- IME 303 Project Organization and Management
- IME 305 Operations Research II
- IME 312 Data Management and System Design
- IME 319 Human Factors Engineering
- IME 336 Computer-Aided Manufacturing II
- IME 400 Special Problems for Advanced Undergraduates
- IME 408 Systems Engineering
- IME 409 Economic Decision Systems
- IME 410 Production Planning and Control Systems
- IME 416 Automation of Industrial Systems
- IME 420 Simulation
- IME 424 Industrial Engineering in Healthcare
- IME 428 Engineering Metrology
- IME 429 Ergonomics Laboratory
- IME 432 Additive Manufacturing
- IME 435 Reliability for Design and Testing
- IME 443 Facilities Planning and Design
- IME 451 Radio Frequency Identification and Sensing System Design
- IME 457 Advanced Electronic Manufacturing
- IME/MATE 458/ CPE 488 Microelectronics and Electronics Packaging
- IME 470 Selected Advanced Topics
- IME 471 Selected Advanced Laboratory
- IME 510 Systems Engineering I
- IME 511 Systems Engineering II
Category B

BMED 212 Introduction to Biomedical Engineering Design
BUS/ENGR 310 Introduction to Entrepreneurship
BUS 311 Managing Technology in the International Legal Environment
BUS 346 Principles of Marketing
BUS 382 Leadership and Organizations
BUS 402 International Business Management
CE 207 Mechanics of Materials II
ENGR 350 The Global Environment
IME 401 Sales Engineering
IME 421 Manufacturing Organizations
IME 441 Engineering Supervision I
IME 460 Introduction to Value Chain Analysis
ITP 326 Product Design and Development
ITP 330 Packaging Fundamentals
ITP 341 Packaging Polymers and Processing
ITP 371 Supply Chain Management in Manufacturing and Services
ITP 406 Professional Technical Selling
ITP 428 Commercialization of New Technologies
MATH 344 Linear Analysis II
MATH 350 Mathematical Software

SUPPORT COURSES

BIO 213 Life Science for Engineers and Bioengineering Fundamentals (B2)
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
CSC 232 Computer Programming for Scientists and Engineers

IM 520 Advanced Information Systems for Operations
IM 527 Design of Experiments
IM 541 Advanced Operations Research
IM 542 Applied Reliability Engineering
IM 543 Applied Human Factors
IM 544 Advanced Topics in Engineering Economy
IM 545 Advanced Topics in Simulation
MATE 410 Nanoscale Engineering
MATE 430 Micro/Nano Fabrication
MATE 440 Welding Metallurgy and Joining of Advanced Materials
MATE 445 Joining of Advanced Materials Laboratory
ME 305 Introduction to Mechatronics
ME 341 Fluid Mechanics I
ME 415 Energy Conversion

EE 201 Electric Circuit Theory
EE 251 Electric Circuits Laboratory
EE 321 Electronics
ENGL 149 Technical Writing for Engineers (A3)
MATE 210 Materials Engineering
MATE 215 Materials Laboratory I
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
ME 212 Engineering Dynamics
ME 302 Thermodynamics I
ME 312 Engineering Statics
ME 313 General Physics II
ME 333 General Physics III
PHYS 133 General Physics II
PHYS 134 General Physics III
PHYS 141 General Physics IA (Area B Electives)
STAT 321 Probability and Statistics for Engineers and Scientists (Upper-Division B)

GENERAL EDUCATION (GE)

(See GE program requirements below.)

FREE ELECTIVES

Free Electives 0

Total units 192

1 ENGR 459, ENGR 460 and ENGR 461 (6) may substitute for IME 481, IME 482 and IME 483 (6).
2 ENGR 463, ENGR 464 and ENGR 465 (6) may substitute for IME 481, IME 482 and IME 483 (6).
3 If a course is taken to meet the Technical Electives requirement, it cannot be double-counted to satisfy another Major or Support requirement.
4 Consultation with an advisor is recommended prior to selecting Technical Electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals. Upper-division courses not on this list may substitute as Technical Electives, if approved by an advisor and the Industrial and Manufacturing Engineering department chair.
5 CE 208 (5) may substitute for both CE 204 (3) and CE 207 (2).
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).
<table>
<thead>
<tr>
<th>Area A</th>
<th>English Language Communication and Critical Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Oral Communication</td>
</tr>
<tr>
<td>A2</td>
<td>Written Communication</td>
</tr>
<tr>
<td>A3</td>
<td>Critical Thinking (4 units in Support)</td>
</tr>
<tr>
<td>Area B</td>
<td>Scientific Inquiry and Quantitative Reasoning</td>
</tr>
<tr>
<td>B1</td>
<td>Physical Science (4 units in Support)</td>
</tr>
<tr>
<td>B2</td>
<td>Life Science (4 units in Support)</td>
</tr>
<tr>
<td>B3</td>
<td>One lab taken with either a B1 or B2 course</td>
</tr>
<tr>
<td>B4</td>
<td>Mathematics/Quantitative Reasoning (8 units in Support)</td>
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<tr>
<td></td>
<td>Upper-Division B (4 units in Support)</td>
</tr>
<tr>
<td></td>
<td>Area B Electives (8 units in Support)</td>
</tr>
<tr>
<td>Area C</td>
<td>Arts and Humanities</td>
</tr>
<tr>
<td></td>
<td>Lower-division courses in Area C must come from three different subject prefixes.</td>
</tr>
<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>
</tr>
<tr>
<td></td>
<td>Lower-Division C Elective - Select a course from either C1 or C2.</td>
</tr>
<tr>
<td></td>
<td>Upper-Division C</td>
</tr>
<tr>
<td>Area D</td>
<td>Social Sciences</td>
</tr>
<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>
</tr>
<tr>
<td></td>
<td>Area D Elective - Select either a lower-division or upper-division course.</td>
</tr>
<tr>
<td>Area E</td>
<td>Lifelong Learning and Self-Development</td>
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<td></td>
<td>Lower-Division E</td>
</tr>
<tr>
<td></td>
<td>Total units</td>
</tr>
</tbody>
</table>

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