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 Code</th>
<th>Course 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>or IME 315</td>
<td>Financial Decision Making for Engineers</td>
<td></td>
</tr>
<tr>
<td>IME 327</td>
<td>Test Design and Analysis in Manufacturing Engineering</td>
<td>4</td>
</tr>
</tbody>
</table>

IME 330   Fundamentals of Manufacturing Engineering  4
IME 335   Computer-Aided Manufacturing I  4
IME 342   Manufacturing Systems Integration  4
IME 356   Manufacturing Automation  4
IME 417   Supply Chain and Logistics Management  4
IME 418   Product-Process Design  4
IME 430   Quality Engineering  4
IME 450   Manufacturing Process and Tool Engineering  4
IME 481   Senior Design Project I  6
& IME 482 & IME 483 & Senior Design Project II & Senior Design Project III 1, 2

Technical Electives

Select from Category A (8-13 units) & Category B (0-5 units) below: 3, 4

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
IMSE 520  Advanced Information Systems for Operations
IMSE 527  Design of Experiments
IMSE 541  Advanced Operations Research
IMSE 542  Applied Reliability Engineering
IMSE 543  Applied Human Factors
IMSE 544  Advanced Topics in Engineering Economy
IMSE 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

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
IMSE 401  Sales Engineering
IMSE 421  Manufacturing Organizations
IMSE 441  Engineering Supervision I
IMSE 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)
& BMED 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

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
PHYS 131  General Physics IA (Area B Electives)
PHYS 132  General Physics II
PHYS 133  General Physics III
STAT 321  Probability and Statistics for Engineers and Scientists (Upper-Division B)

GENERAL EDUCATION (GE)
(See GE program requirements below.)

FREE ELECTIVES
Free Electives

Total units
192

1 ENGR 459, ENGR 460 and ENGR 461 (6) may substitute for IMSE 481, IMSE 482 and IMSE 483 (6).
2 ENGR 463, ENGR 464 and ENGR 465 (6) may substitute for IMSE 481, IMSE 482 and IMSE 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 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/#generaleducationcontext).
- 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>
</tr>
<tr>
<td>Upper-Division B (4 units in Support)</td>
<td>0</td>
</tr>
<tr>
<td>Area B Electives (8 units in Support)</td>
<td>0</td>
</tr>
<tr>
<td>Area C</td>
<td>Arts and Humanities</td>
</tr>
<tr>
<td>Lower-division courses in Area C must come from three different subject prefixes.</td>
<td></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>Lower-Division C Elective - Select a course from either C1 or C2.</td>
<td>4</td>
</tr>
<tr>
<td>Upper-Division C</td>
<td>4</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>Area D Elective - Select either a lower-division or upper-division course.</td>
<td>4</td>
</tr>
<tr>
<td>Area E</td>
<td>Lifelong Learning and Self-Development</td>
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<tr>
<td>Lower-Division E</td>
<td>4</td>
</tr>
<tr>
<td>Total units</td>
<td>40</td>
</tr>
</tbody>
</table>

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