BS MANUFACTURING ENGINEERING

Program Learning Outcomes

1. An ability to apply knowledge of mathematics, science, and engineering (includes proficiency in materials)
2. An ability to design and conduct experiments, as well as to analyze and interpret data (includes manufacturing laboratory or facility experience, the ability to measure manufacturing process variables and develop technical inferences about the process)
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (includes proficiency in manufacturing processes, the ability to design manufacturing processes that result in products that meet specific material and other requirements; proficiency in process, assembly and product engineering, the ability to design products and the equipment, tooling, and environment necessary for their manufacture; and proficiency in manufacturing systems design, the ability to analyze, synthesize, and control manufacturing operations using statistical methods)
4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate, and solve engineering problems
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (includes manufacturing competitiveness, of the ability to create competitive advantage through manufacturing planning, strategy, quality, and control)
9. A recognition of the need for, and an ability to engage in life-long learning
10. A knowledge of contemporary issues
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

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>IME 327</td>
<td>Test Design and Analysis in Manufacturing Engineering</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>
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</tr>
<tr>
<td>IME 481</td>
<td>Senior Design Project I 6,7</td>
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</tr>
<tr>
<td>IME 482</td>
<td>Senior Design Project II 6,7</td>
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Technical Electives 2, 3, 4, 5

Select from the following:

AG/ISLA/EDES/ENGR/SCM/UNIV 350  The Global Environment
BMED 212  Introduction to Biomedical Engineering Design
BMED 410  Biomechanics
BUS 310  Introduction to Entrepreneurship
BUS 311  Managing Technology in the International Legal Environment
BUS 346  Principles of Marketing
CE 207  Mechanics of Materials II
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/HNRS 322  Leadership and Project Management
IME 336  Computer-Aided Manufacturing II
IME 351  Advanced Material Removal Process Design
IME 401  Sales Engineering
IME 408  Systems Engineering
IME 410  Production Planning and Control Systems
IME 416  Automation of Industrial Systems
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>IME 420</td>
<td>Simulation</td>
<td></td>
</tr>
<tr>
<td>IME 421</td>
<td>Manufacturing Organizations</td>
<td></td>
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<tr>
<td>IME 428</td>
<td>Engineering Metrology</td>
<td></td>
</tr>
<tr>
<td>IME 429</td>
<td>Ergonomics Laboratory</td>
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<tr>
<td>IME 432</td>
<td>Additive Manufacturing</td>
<td></td>
</tr>
<tr>
<td>IME 435</td>
<td>Reliability for Design and Testing</td>
<td></td>
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<tr>
<td>IME 441</td>
<td>Engineering Supervision I</td>
<td></td>
</tr>
<tr>
<td>IME 442</td>
<td>Engineering Supervision II</td>
<td></td>
</tr>
<tr>
<td>IME 443</td>
<td>Facilities Planning and Design</td>
<td></td>
</tr>
<tr>
<td>IME 451</td>
<td>Radio Frequency Identification System Design</td>
<td></td>
</tr>
<tr>
<td>IME 457</td>
<td>Advanced Electronic Manufacturing</td>
<td></td>
</tr>
<tr>
<td>IME/MATE 458/</td>
<td>Microelectronics and Electronics</td>
<td></td>
</tr>
<tr>
<td>CPE 488</td>
<td>Packaging</td>
<td></td>
</tr>
<tr>
<td>IME 460</td>
<td>Introduction to Value Chain Analysis</td>
<td></td>
</tr>
<tr>
<td>IME 470</td>
<td>Selected Advanced Topics</td>
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<tr>
<td>IME 471</td>
<td>Selected Advanced Laboratory</td>
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</tr>
<tr>
<td>IME/AERO 510</td>
<td>Systems Engineering I</td>
<td></td>
</tr>
<tr>
<td>IME/AERO 511</td>
<td>Systems Engineering II</td>
<td></td>
</tr>
<tr>
<td>IME 520</td>
<td>Advanced Information Systems for Operations</td>
<td></td>
</tr>
<tr>
<td>IME 527</td>
<td>Design of Experiments</td>
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</tr>
<tr>
<td>IME 541</td>
<td>Advanced Operations Research</td>
<td></td>
</tr>
<tr>
<td>IME 542</td>
<td>Applied Reliability Engineering</td>
<td></td>
</tr>
<tr>
<td>IME 543</td>
<td>Applied Human Factors</td>
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<tr>
<td>IME 544</td>
<td>Advanced Topics in Engineering Economy</td>
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<tr>
<td>ITP 326</td>
<td>Product Design and Development</td>
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<tr>
<td>ITP 329</td>
<td>Industrial Materials</td>
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<tr>
<td>ITP 330</td>
<td>Packaging Fundamentals</td>
<td></td>
</tr>
<tr>
<td>ITP 341</td>
<td>Packaging Polymers and Processing</td>
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</tr>
<tr>
<td>ITP 371</td>
<td>Supply Chain Management in Manufacturing and Services</td>
<td></td>
</tr>
<tr>
<td>ITP 406</td>
<td>Industrial Sales</td>
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<tr>
<td>ITP 428</td>
<td>Commercialization of New Technologies</td>
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</tr>
<tr>
<td>MATE 410</td>
<td>Nanoscale Engineering</td>
<td></td>
</tr>
<tr>
<td>MATE 430</td>
<td>Micro/Nano Fabrication</td>
<td></td>
</tr>
<tr>
<td>MATE 440</td>
<td>Welding Metallurgy and Joining of Advanced Materials</td>
<td></td>
</tr>
<tr>
<td>MATE 445</td>
<td>Joining of Advanced Materials Laboratory</td>
<td></td>
</tr>
<tr>
<td>MATH 344</td>
<td>Linear Analysis II</td>
<td></td>
</tr>
<tr>
<td>MATH 350</td>
<td>Mathematical Software</td>
<td></td>
</tr>
<tr>
<td>ME 305</td>
<td>Introduction to Mechatronics</td>
<td></td>
</tr>
<tr>
<td>ME 341</td>
<td>Fluid Mechanics I</td>
<td></td>
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<tr>
<td>ME 415</td>
<td>Energy Conversion</td>
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**SUPPORT COURSES**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>BIO 213 &amp; BMED 213</td>
<td>Life Science for Engineers and Bioengineering Fundamentals (B2)</td>
<td>4</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 (B3/B4)</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 125</td>
<td>General Chemistry for Physical Science and Engineering II</td>
<td>4</td>
</tr>
<tr>
<td>CSC 232</td>
<td>Computer Programming for Scientists and Engineers</td>
<td></td>
</tr>
<tr>
<td>EE 201</td>
<td>Electric Circuit Theory</td>
<td>3</td>
</tr>
<tr>
<td>EE 251</td>
<td>Electric Circuits Laboratory</td>
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</tr>
<tr>
<td>EE 321</td>
<td>Electronics</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 149</td>
<td>Technical Writing for Engineers (A3)</td>
<td>4</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>
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</tr>
<tr>
<td>MATH 141</td>
<td>Calculus I (B1)</td>
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</tr>
<tr>
<td>MATH 142</td>
<td>Calculus II (B1)</td>
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</tr>
<tr>
<td>MATH 143</td>
<td>Calculus III (Add'l Area B)</td>
<td>4</td>
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<tr>
<td>MATH 241</td>
<td>Calculus IV</td>
<td>4</td>
</tr>
<tr>
<td>MATH 244</td>
<td>Linear Analysis I</td>
<td>4</td>
</tr>
<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</td>
<td>3</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>PHYS 141</td>
<td>General Physics IA (Add'l Area B)</td>
<td>4</td>
</tr>
<tr>
<td>STAT 321</td>
<td>Probability and Statistics for Engineers and Scientists (B6)</td>
<td>4</td>
</tr>
</tbody>
</table>

**GENERAL EDUCATION (GE)**

(See GE program requirements below.)

**FREE ELECTIVES**

Free Electives: 0

Total units: 192

1. Required in Support; also satisfies GE
2. The courses selected to satisfy this requirement may not be used to satisfy other major, support, or general education requirements (no double counting of coursework).
3. At least 10 units must be upper level (300-level or above) engineering or computer science courses.
4. A maximum of 4 units of technical electives may be upper level (300-level or above) courses from outside of the College of Engineering or lower level (100 or 200 level) engineering or computer science courses.
5. Students may take other 300 level or above courses not in the list subject to the approval by advisor and IME department chair. Consultation with advisor is recommended prior to selecting technical electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
6. ENGR 459, ENGR 460 and ENGR 461 (6) may substitute for IME 481 and IME 482 (5) with the one excess unit counting towards Technical Electives.
7. ENGR 463, ENGR 464 and ENGR 465 (6) may substitute for IME 481 and IME 482 (5) with the one excess unit counting towards Technical Electives.

**General Education (GE) Requirements**

- 72 units required, 32 of which are specified in Major and/or Support.
- See the complete GE course listing (http://catalog.calpoly.edu/generalrequirementsbachelorsdegree/#generaleducationtext).
• Minimum of 8 units required at the 300 level.

<table>
<thead>
<tr>
<th>Area A</th>
<th>Communication</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Expository Writing</td>
<td>4</td>
</tr>
<tr>
<td>A2</td>
<td>Oral Communication</td>
<td>4</td>
</tr>
<tr>
<td>A3</td>
<td>Reasoning, Argumentation and Writing (4 units in Support)</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area B</th>
<th>Science and Mathematics</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Mathematics/Statistics (8 units in Support)</td>
<td>0</td>
</tr>
<tr>
<td>B2</td>
<td>Life Science (4 units in Support)</td>
<td>0</td>
</tr>
<tr>
<td>B3</td>
<td>Physical Science (4 units in Support)</td>
<td>0</td>
</tr>
<tr>
<td>B4</td>
<td>One lab taken with either a B2 or B3 course</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area B</th>
<th>Upper-division Area B (4 units in Support)</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>B6</td>
<td></td>
<td>0</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Area C</th>
<th>Arts and Humanities</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Literature</td>
<td>4</td>
</tr>
<tr>
<td>C2</td>
<td>Philosophy</td>
<td>4</td>
</tr>
<tr>
<td>C3</td>
<td>Fine/Performing Arts</td>
<td>4</td>
</tr>
<tr>
<td>C4</td>
<td>Upper-division elective</td>
<td>4</td>
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</table>

<table>
<thead>
<tr>
<th>Area D/E</th>
<th>Society and the Individual</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>The American Experience (Title 5, Section 40404 requirement) (40404)</td>
<td>4</td>
</tr>
<tr>
<td>D2</td>
<td>Political Economy</td>
<td>4</td>
</tr>
<tr>
<td>D3</td>
<td>Comparative Social Institutions</td>
<td>4</td>
</tr>
<tr>
<td>D4</td>
<td>Self Development (CSU Area E)</td>
<td>4</td>
</tr>
</tbody>
</table>

Total units: 40

\(^1\) Required in Support; also satisfies GE