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</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>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<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>
<td>4</td>
</tr>
<tr>
<td>IME 481</td>
<td>Senior Design Project I</td>
<td>2</td>
</tr>
<tr>
<td>IME 482</td>
<td>Senior Design Project II</td>
<td>3</td>
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</table>

Technical Electives

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
BS Manufacturing Engineering

IME 420  Simulation  4
IME 421  Manufacturing Organizations  4
IME 428  Engineering Metrology  3
IME 429  Ergonomics Laboratory  3
IME 432  Additive Manufacturing  3
IME 435  Reliability for Design and Testing  3
IME 441  Engineering Supervision I  1
IME 442  Engineering Supervision II  1
IME 443  Facilities Planning and Design  1
IME 451  Radio Frequency Identification  1
IME 457  Advanced Electronic Manufacturing  1
IME/MATE 458/ CPE 488  Microelectronics and Electronics Packaging  1
IME 470  Selected Advanced Topics  1
IME 471  Selected Advanced Laboratory  1
IME/AERO 510  Systems Engineering I  1
IME/AERO 511  Systems Engineering II  1
IME 520  Advanced Information Systems for Operations  1
IME 527  Design of Experiments  1
IME 541  Advanced Operations Research  1
IME 542  Applied Reliability Engineering  1
IME 543  Applied Human Factors  1
IME 544  Advanced Topics in Engineering Economy  1
ITP 326  Product Design and Development  1
ITP 329  Industrial Materials  1
ITP 330  Packaging Fundamentals  1
ITP 341  Packaging Polymers and Processing  1
ITP 371  Supply Chain Management in Manufacturing and Services  1
ITP 406  Industrial Sales  1
ITP 428  Commercialization of New Technologies  1
MATE 410  Nanoscale Engineering  1
MATE 430  Micro/Nano Fabrication  1
MATE 440  Welding Metallurgy and Joining of Advanced Materials  1
MATE 445  Joining of Advanced Materials Laboratory  1
MATH 344  Linear Analysis II  1
MATH 350  Mathematical Software  1
ME 305  Introduction to Mechatronics  1
ME 341  Fluid Mechanics I  1
ME 415  Energy Conversion  1

SUPPORT COURSES

BIO 213  Life Science for Engineers (B2)  1
& BMED 213  Life Science for Engineers and Bioengineering Fundamentals (B2)  1
CE 204  Mechanics of Materials I  1
CHEM 124  General Chemistry for Physical Science and Engineering I (B3/B4)  1

CHEM 125  General Chemistry for Physical Science and Engineering II  4
CSC 232  Computer Programming for Scientists and Engineers  3
EE 201  Electric Circuit Theory  3
EE 251  Electric Circuits Laboratory  3
EE 321  Electronics  3
ENGL 149  Technical Writing for Engineers (A3)  4
MATE 210  Materials Engineering  3
MATE 215  Materials Laboratory I  1
MATH 141  Calculus I (B1)  4
MATH 142  Calculus II (B1)  4
MATH 143  Calculus III (Add'l Area B)  4
MATH 241  Calculus IV  4
MATH 244  Linear Analysis I  4
ME 211  Engineering Statics  3
ME 212  Engineering Dynamics  3
ME 302  Thermodynamics I  3
PHYS 132  General Physics II  4
PHYS 133  General Physics III  4
PHYS 141  General Physics I (Add'l Area B)  4
STAT 321  Probability and Statistics for Engineers and Scientists (B6)  4

GENERAL EDUCATION (GE)
(See GE program requirements below.)  40

FREE ELECTIVES

Free Electives  4

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.

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.

Area A  Communication

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.
<table>
<thead>
<tr>
<th>Area</th>
<th>Course Description</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>
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<tr>
<td>A3</td>
<td>Reasoning, Argumentation and Writing (4 units in Support)</td>
<td>0</td>
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<tr>
<td>Area B</td>
<td>Science and Mathematics</td>
<td></td>
</tr>
<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>
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<tr>
<td>B3</td>
<td>Physical Science (4 units in Support)</td>
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<tr>
<td>B4</td>
<td>One lab taken with either a B2 or B3 course</td>
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<tr>
<td>B6</td>
<td>Upper-division Area B (4 units in Support)</td>
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<tr>
<td>Area C</td>
<td>Arts and Humanities</td>
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<tr>
<td>C1</td>
<td>Literature</td>
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<tr>
<td>C2</td>
<td>Philosophy</td>
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<tr>
<td>C3</td>
<td>Fine/Performing Arts</td>
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<tr>
<td>C4</td>
<td>Upper-division elective</td>
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<tr>
<td>Area D/E</td>
<td>Society and the Individual</td>
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<tr>
<td>D1</td>
<td>The American Experience (Title 5, Section 40404 requirement) (40404)</td>
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<tr>
<td>D2</td>
<td>Political Economy</td>
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<tr>
<td>D3</td>
<td>Comparative Social Institutions</td>
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<tr>
<td>D4</td>
<td>Self Development (CSU Area E)</td>
<td>4</td>
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<tr>
<td>Total units</td>
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<td>40</td>
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</tbody>
</table>

1 Required in Support; also satisfies GE