# 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, 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, 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>
<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>
</tr>
</tbody>
</table>

### Technical Electives

Select from the following: 14

- 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
IME 420  Simulation
IME 421  Manufacturing Organizations
IME 428  Engineering Metrology
IME 429  Ergonomics Laboratory
IME 432  Additive Manufacturing
IME 435  Reliability for Design and Testing
IME 441  Engineering Supervision I
IME 442  Engineering Supervision II
IME 443  Facilities Planning and Design
IME 451  Radio Frequency Identification 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/AERO 510  Systems Engineering I
IME/AERO 511  Systems Engineering II
IME 520  Advanced Information Systems for Operations
IME 527  Design of Experiments
IME 541  Advanced Operations Research
IME 542  Applied Reliability Engineering
IME 543  Applied Human Factors
IME 544  Advanced Topics in Engineering Economy
ITP 326  Product Design and Development
ITP 329  Industrial Materials
ITP 330  Packaging Fundamentals
ITP 341  Packaging Polymers and Processing
ITP 371  Supply Chain Management in Manufacturing and Services
ITP 406  Industrial Sales
ITP 428  Commercialization of New Technologies
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
MATH 344  Linear Analysis II
MATH 350  Mathematical Software
ME 305  Introduction to Mechatronics
ME 341  Fluid Mechanics I
ME 415  Energy Conversion

SUPPORT COURSES

BIO 213  Life Science for Engineers 4
&B MED 213  and Bioengineering Fundamentals (B2) 1
CE 204  Mechanics of Materials I 3
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 1
EE 321  Electronics 3
ENGL 149  Technical Writing for Engineers (A3) 1 4
MATE 210  Materials Engineering 3
MATE 215  Materials Laboratory I 1
MATH 141  Calculus I (B1) 1 4
MATH 142  Calculus II (B1) 1 4
MATH 143  Calculus III (Add'l Area B) 1 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 IA (Add'l Area B) 1 4
STAT 321  Probability and Statistics for Engineers and Scientists (B6) 1 4

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.

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
<table>
<thead>
<tr>
<th>Area</th>
<th>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>
</tr>
<tr>
<td>A3</td>
<td>Reasoning, Argumentation and Writing (4 units in Support) ¹</td>
<td>0</td>
</tr>
<tr>
<td>Area B</td>
<td>Science and Mathematics</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>Mathematics/Statistics (8 units in Support) ¹</td>
<td>0</td>
</tr>
<tr>
<td>B2</td>
<td>Life Science (4 units in Support) ¹</td>
<td>0</td>
</tr>
<tr>
<td>B3</td>
<td>Physical Science (4 units in Support) ¹</td>
<td>0</td>
</tr>
<tr>
<td>B4</td>
<td>One lab taken with either a B2 or B3 course</td>
<td></td>
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<tr>
<td>B6</td>
<td>Upper-division Area B (4 units in Support) ¹</td>
<td>0</td>
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<tr>
<td>Area C</td>
<td>Arts and Humanities</td>
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</tr>
<tr>
<td>C1</td>
<td>Literature</td>
<td>4</td>
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<tr>
<td>C2</td>
<td>Philosophy</td>
<td>4</td>
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<tr>
<td>C3</td>
<td>Fine/Performing Arts</td>
<td>4</td>
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<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>
<td>4</td>
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<tr>
<td>D2</td>
<td>Political Economy</td>
<td>4</td>
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<tr>
<td>D3</td>
<td>Comparative Social Institutions</td>
<td>4</td>
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<tr>
<td>D4</td>
<td>Self Development (CSU Area E)</td>
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<tr>
<td>Total units</td>
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<td>40</td>
</tr>
</tbody>
</table>

¹ Required in Support; also satisfies GE