Mechanical Engineering Undergraduate Major

See the "Department of Mechanical Engineering (http://exploreddegrees.stanford.edu/schoolofengineering/mechanicalengineering)" section of this bulletin for additional information on the department, and its programs and faculty.

The department offers a B.S. as well as a minor in Mechanical Engineering.

Mechanical Engineering (ME)

Completion of the undergraduate program in Mechanical Engineering leads to the conferral of the Bachelor of Science in Mechanical Engineering.

Mission of the Undergraduate Program in Mechanical Engineering

The mission of the undergraduate program in Mechanical Engineering is to provide students with a balance of theoretical and practical experiences that enable them to address a variety of societal needs. The curriculum encompasses elements from a wide range of disciplines built around the themes of biomechanics, computational engineering, design, energy, and multiscale engineering. Course work may include experiences that enable them to address a variety of societal needs.

Core Requirements

The mission of the undergraduate program in Mechanical Engineering is to provide students with a balance of theoretical and practical experiences that enable them to address a variety of societal needs. The curriculum encompasses elements from a wide range of disciplines built around the themes of biomechanics, computational engineering, design, energy, and multiscale engineering. Course work may include experiences that enable them to address a variety of societal needs.

Core Requirements

Mathematics

24 units minimum; see Basic Requirement 1

CME 102/ENGR 155A Ordinary Differential Equations for Engineers 5

or MATH 53 Ordinary Differential Equations with Linear Algebra

Select one of the following: 3-5

CME 106/ENGR 155C Introduction to Probability and Statistics for Engineers

STATS 110 Statistical Methods in Engineering and the Physical Sciences

STATS 116 Theory of Probability

Plus additional courses to total min. 24

Science

20 units minimum; see Basic Requirement 2

CHEM 31X Chemical Principles Accelerated 5

Plus additional required courses

Technology in Society

One course required; TIS courses should be selected from AA 252, BIOE 131, CS 181, ENGR 131 or ME 267 3-5

Engineering Fundamentals

Two courses minimum; see Basic Requirement 3

ENGR 14 Intro to Solid Mechanics 3

ENGR 70A Programming Methodology (same as CS 106A) 5

Engineering Core

Minimum of 68 Engineering Science and Design ABET units; see Basic Requirement 5

ME 1 Introduction to Mechanical Engineering 3

ENGR 15 Dynamic 3

ME 80 Mechanics of Materials 3

ME 30 Engineering Thermodynamics 3

ME 70 Introductory Fluids Engineering 3

ME 131A Heat Transfer 3

ME 102 Foundations of Product Realization 3

ME 103 Product Realization: Design and Making 3

ME 112 Mechanical Systems Design 3

ME 123 Computational Engineering 4

ME 170A Mechanical Engineering Design- Integrating Context with Engineering 4

ME 170B Mechanical Engineering Design: Integrating Context with Engineering 4

Core Concentrations and Concentration Electives

In addition to completing core requirements, students must choose one of the concentrations paths below. In addition to their concentration specific 3-courses, students select 2-3 additional courses such that the combination adds up to a minimum of 18 units. One of these additional courses must be from technical electives associated with the student's selected concentration. The other 1-2 courses could come from either technical electives from the student's selected concentration or any other concentration and its associated technical electives.

Dynamic Systems and Controls Concentration

ME 161 Dynamic Systems, Vibrations and Control 3

ENGR 105 Feedback Control Design 3

Pick one of:

ME 227 Vehicle Dynamics and Control 3

ME 327 Design and Control of Haptic Systems 3

Dynamic Systems and Controls Electives

ME 171E Aerial Robot Design 4

ENGR 205 Introduction to Control Design Techniques 3

ME 210 Introduction to Mechatronics 4

ME 220 Introduction to Sensors 3-4

ME 331A Advanced Dynamics & Computation 3

ME 485 Modeling and Simulation of Human Movement 3

Pick one, if not used in concentration already:

ME 227 Vehicle Dynamics and Control 3

ME 327 Design and Control of Haptic Systems 3

Materials and Structures Concentration

ME 149 Mechanical Measurements 3

ME 151 Introduction to Computational Mechanics 3

ME 152 Material Behaviors and Failure Prediction 3

Materials and Structures Electives

ME 234 Introduction to Neuromechanics 3

ME 241 Mechanical Behavior of Nanomaterials 3

ME 281 Biomechanics of Movement 3

ME 283 Introduction to Biomechancs and Mechanobiology 3

ME 287 Mechanics of Biological Tissues 4

ME 331A Advanced Dynamics & Computation 3
ME 335A  Finite Element Analysis  3  
ME 338  Continuum Mechanics  3  
ME 339  Introduction to parallel computing using MPI, openMP and CUDA  3  
ME 345  Fatigue Design and Analysis  3  
ME 348  Experimental Stress Analysis  3  

Units

Product Realization Concentration
ME 127  Design for Additive Manufacturing  3  
ME 128  Computer-Aided Product Realization  3  
ME 129  (offered AY 19-20)  3  

Product Realization Electives
ENGR 110  Perspectives in Assistive Technology  3  
ENGR 240  Introduction to Micro and Nano Electromechanical Systems  3  
ME 181  Deliverables: A Mechanical Engineering Design Practicum  3  
CME 106  Introduction to Probability and Statistics for Engineers  4  
ME 210  Introduction to Mechatronics  4  
ME 263  The Chair or ME 298  Silversmithing and Design  3-4  
ME 309  Finite Element Analysis in Mechanical Design  3  
ME 324  Precision Engineering  4  

Thermo, Fluids, and Heat Transfer Concentration
ME 132  Intermediate Thermodynamics  4  
ME 133  Intermediate Fluid Mechanics  3  
ME 149  Mechanical Measurements  3  

Thermo, Fluids, and Heat Transfer Electives
ME 250  Internal Combustion Engines  1-5  
ME 257  Gas-Turbine Design Analysis  3  
ME 351A  Fluid Mechanics  3  
ME 351B  Fluid Mechanics  3  
ME 352A  Radiative Heat Transfer  3  
ME 352B  Fundamentals of Heat Conduction  3  
ME 352C  Convective Heat Transfer  3  
ME 362A  Physical Gas Dynamics  3  
ME 370A  Energy Systems I: Thermodynamics  3  
ME 370B  Energy Systems II: Modeling and Advanced Concepts  4  
ME 371  Combustion Fundamentals  3  
AA 283  Aircraft and Rocket Propulsion  3  

1 Math and science must total 45 units.
   • Math: 24 units required and must include a course in differential equations (CME 102 Ordinary Differential Equations for Engineers or MATH 53 Ordinary Differential Equations with Linear Algebra; one of these required) and calculus-based Statistics (CME 106 Introduction to Probability and Statistics for Engineers or STATS 110 Statistical Methods in Engineering and the Physical Sciences or STATS 116 is required).
   • Science: 20 units minimum and requires courses in calculus-based Physics and Chemistry, with at least a full year (3 courses) in one or the other. CHEM 31A Chemical Principles I/CHEM 31B Chemical Principles II are considered one course because they cover the same material as CHEM 31X Chemical Principles Accelerated but at a slower pace. CHEM 31X Chemical Principles Accelerated is recommended.

2 ME 112 fulfills the WIM requirement.

3 ME 170A and ME 170B are a two quarter Capstone Design Sequence and must be taken in consecutive quarters.
4 A course may only be counted towards one requirement; it may not be double-counted. All courses taken for the major must be taken for a letter grade if that option is offered by the instructor. Minimum combined GPA for all courses in Engineering Topics (Engineering Fundamentals and Depth courses) is 2.0.
5 ME 129 will be offered Winter Quarter of AY 2019-20. Product realization students should take one of their concentration electives, or ME 219, in AY 2018-19.

For additional information and sample programs see the Handbook for Undergraduate Engineering Programs (UGHB) (http://ughb.stanford.edu).

BSME 1.0 Student Notes
Those students (primarily juniors and seniors) who are completing BSME 1.0 from prior years should refer to bulletins from the academic year that corresponds with their program sheet.

The following exception will be made for BSME 1.0 students in the AY 2018-19 year:
   • ME 131B or ME 133 may be taken to fulfill that course requirement

Honors Program in Mechanical Engineering
The Department of Mechanical Engineering offers a program leading to a B.S. in Mechanical Engineering with honors. This program offers a unique opportunity for qualified undergraduate engineering majors to conduct independent study and research at an advanced level with a faculty mentor.

Mechanical Engineering majors who have a grade point average (GPA) of 3.5 or higher in the major may apply for the honors program. Students who meet the eligibility requirement and wish to be considered for the honors program must submit a written application to the Mechanical Engineering student services office no later than the second week of Autumn Quarter in the senior year. The application to enter the program can be obtained from the ME student services office, and must contain a one-page statement describing the research topic and include an unofficial Stanford transcript. In addition, the application must be approved by a Mechanical Engineering faculty member who agrees to serve as the thesis adviser for the project. Thesis advisers must be members of Stanford’s Academic Council.

In order to receive departmental honors, students admitted to the program must:
1. Maintain the 3.5 GPA required for admission to the honors program.
2. Submit a completed thesis draft to the adviser by the 3rd week of the quarter they intend to confer. Further revisions and final endorsement by the adviser are to be finished by week 6, when two bound copies are to be submitted to the Mechanical Engineering student services office.
3. Present the thesis at the Mechanical Engineering Poster Session held in mid-April. If the poster session is not offered or the student does not confer in the spring, an alternative presentation will be approved on a case by case basis with advisor and UGCC chair approval.

Note: Students may not use work completed towards an honors degree to satisfy the B.S. in ME course requirements.

Mechanical Engineering (ME) Minor
The following courses fulfill the minor requirements:
<table>
<thead>
<tr>
<th>General Minor *</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 14 Intro to Solid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 15 Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 1 Introduction to Mechanical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ME 30 Engineering Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 70 Introductory Fluids Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Plus two of the following:</td>
<td></td>
</tr>
<tr>
<td>ME 80 Mechanics of Materials</td>
<td>3</td>
</tr>
<tr>
<td>ME 103 Product Realization: Design and Making</td>
<td>3</td>
</tr>
<tr>
<td>ME 131A Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>ME 161 Dynamic Systems, Vibrations and Control</td>
<td>3</td>
</tr>
<tr>
<td>Total Units: 21</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Thermosciences Minor **</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 14 Intro to Solid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>ME 30 Engineering Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 70 Introductory Fluids Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ME 131A Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>ME 149 Mechanical Measurements</td>
<td>3</td>
</tr>
<tr>
<td>ME 132 Intermediate Thermodynamics</td>
<td>4</td>
</tr>
<tr>
<td>ME 133 Intermediate Fluid Mechanics (offered SPR 18-19; more information to come)</td>
<td>3</td>
</tr>
<tr>
<td>Total units: 22</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanical Design Minor ***</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 14 Intro to Solid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 15 Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 80 Mechanics of Materials</td>
<td>3</td>
</tr>
<tr>
<td>ME 1 Introduction to Mechanical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ME 102 Foundations of Product Realization</td>
<td>3</td>
</tr>
<tr>
<td>ME 103 Product Realization: Design and Making</td>
<td>3</td>
</tr>
<tr>
<td>ME 112 Mechanical Systems Design</td>
<td>3</td>
</tr>
<tr>
<td>Plus one of the following:</td>
<td></td>
</tr>
<tr>
<td>ME 113 Mechanical Engineering Design</td>
<td>4</td>
</tr>
<tr>
<td>ME 210 Introduction to Mechatronics</td>
<td>4</td>
</tr>
<tr>
<td>ME 220 Introduction to Sensors</td>
<td>3-4</td>
</tr>
<tr>
<td>Total units: 24-25</td>
<td></td>
</tr>
</tbody>
</table>

* This minor aims to expose students to the breadth of ME in terms of topics and analytic and design activities. Prerequisites: MATH 19 Calculus, MATH 20 Calculus, MATH 21 Calculus, and PHYSICS 41 Mechanics or PHYSICS 41E Mechanics, Concepts, Calculations, and Context.

** Prerequisites: MATH 19 Calculus, MATH 20 Calculus, MATH 21 Calculus, MATH 51 Linear Algebra, Multivariable Calculus, and Modern Applications (or CME 100 Vector Calculus for Engineers) and PHYSICS 41 Mechanics or PHYSICS 41E Mechanics, Concepts, Calculations, and Context.

*** This minor aims to expose students to design activities supported by analysis. Prerequisites: MATH 19 Calculus, MATH 20 Calculus, MATH 21 Calculus, PHYSICS 42 Classical Mechanics Laboratory, and PHYSICS 41 Mechanics or PHYSICS 41E Mechanics, Concepts, Calculations, and Context.