MECHANICAL ENGINEERING UNDERGRADUATE MAJOR

See the "Department of Mechanical Engineering (http://exploredegrees.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 work as mechanical engineers and for graduate studies in either science and technology, propulsion, sensing and control, nano- and microelectromechanical systems, biomechanical engineering, energy science and technology, propulsion, sensing and control, nano- and micro- mechanics, and design. The program prepares students for entry-level work as mechanical engineers and for graduate studies in either an engineering discipline or other fields where a broad engineering background is useful.

Core Requirements

Mathematics

24 units minimum; see Basic Requirement 1

CME 102/ENGR 155A Ordinary Differential Equations for Engineers

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

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

Engineering Fundamentals

Two courses minimum; see Basic Requirement 3

ENGR 14 Intro to Solid Mechanics

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

Engineering Core

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

ME 1 Introduction to Mechanical Engineering

ENGR 15 Dynamics

ME 80 Mechanics of Materials

ME 30 Engineering Thermodynamics

ME 70 Introductory Fluids Engineering

ME 131A Heat Transfer

ME 102 Foundations of Product Realization

ME 103 Product Realization: Design and Making

ME 112 Mechanical Systems Design

ME 123 Computational Engineering

ME 170A Mechanical Engineering Design: Integrating Context with Engineering

ME 170B Mechanical Engineering Design: Integrating Context with Engineering

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

ENGR 105 Feedback Control Design

Pick one of:

ME 227 Vehicle Dynamics and Control

ME 327 Design and Control of Haptic Systems

Dynamic Systems and Controls Electives

ME 171E Aerial Robot Design

ENGR 205 Introduction to Control Design Techniques

ME 210 Introduction to Mechatronics

ME 220 Introduction to Sensors

ME 331A Advanced Dynamics & Computation

ME 485 Modeling and Simulation of Human Movement

Pick one, if not used in concentration already:

ME 227 Vehicle Dynamics and Control

ME 327 Design and Control of Haptic Systems

Materials and Structures Concentration

ME 149 Mechanical Measurements

ME 151 Introduction to Computational Mechanics

ME 152 Material Behaviors and Failure Prediction

Materials and Structures Electives

ME 234 Introduction to Neuromechanics

ME 241 Mechanical Behavior of Nanomaterials

ME 281 Biomechanics of Movement

ME 283 Introduction to Biomechanics and Mechanobiology

ME 287 Mechanics of Biological Tissues

ME 331A Advanced Dynamics & Computation

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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

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

Product Realization Electives
ENGR 110  Perspectives in Assistive Technology  (ENGR 110)  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  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/CHM 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>
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<tbody>
<tr>
<td>ENGR 14</td>
<td>Intro to Solid Mechanics</td>
</tr>
<tr>
<td>ENGR 15</td>
<td>Dynamics</td>
</tr>
<tr>
<td>ME 1</td>
<td>Introduction to Mechanical Engineering</td>
</tr>
<tr>
<td>ME 30</td>
<td>Engineering Thermodynamics</td>
</tr>
<tr>
<td>ME 70</td>
<td>Introductory Fluids Engineering</td>
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<tr>
<td>Plus two of the following:</td>
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<tr>
<td>ME 80</td>
<td>Mechanics of Materials</td>
</tr>
<tr>
<td>ME 103</td>
<td>Product Realization: Design and Making</td>
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<tr>
<td>ME 131A</td>
<td>Heat Transfer</td>
</tr>
<tr>
<td>ME 161</td>
<td>Dynamic Systems, Vibrations and Control</td>
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<tr>
<td><strong>Total Units: 21</strong></td>
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<tr>
<th>Thermosciences Minor</th>
<th>Units</th>
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<td>ME 149</td>
<td>Mechanical Measurements</td>
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<tr>
<td>ME 132</td>
<td>Intermediate Thermodynamics</td>
</tr>
<tr>
<td>ME 133</td>
<td>Intermediate Fluid Mechanics (offered SPR 18-19; more information to come)</td>
</tr>
<tr>
<td><strong>Total units: 22</strong></td>
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<table>
<thead>
<tr>
<th>Mechanical Design Minor</th>
<th>Units</th>
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<tbody>
<tr>
<td>ENGR 14</td>
<td>Intro to Solid Mechanics</td>
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<td>ME 80</td>
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<td>ME 1</td>
<td>Introduction to Mechanical Engineering</td>
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<tr>
<td>ME 102</td>
<td>Foundations of Product Realization</td>
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<tr>
<td>ME 103</td>
<td>Product Realization: Design and Making</td>
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<tr>
<td>ME 112</td>
<td>Mechanical Systems Design</td>
</tr>
<tr>
<td>Plus one of the following:</td>
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<tr>
<td>ME 113</td>
<td>Mechanical Engineering Design</td>
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<tr>
<td>ME 210</td>
<td>Introduction to Mechatronics</td>
</tr>
<tr>
<td>ME 220</td>
<td>Introduction to Sensors</td>
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<tr>
<td><strong>Total units: 24-25</strong></td>
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* 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.