### Core Requirements

The curriculum encompasses elements from a wide range of disciplines built around the themes of biomedicine, computational engineering, design, energy, and multiscale engineering. Course work may include mechatronics, computational simulation, solid and fluid dynamics, 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.

#### Mathematics

<table>
<thead>
<tr>
<th>Units</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>24 units minimum; see Basic Requirement</td>
<td>1</td>
</tr>
<tr>
<td>CME 102/ENGR 155A Ordinary Differential Equations for Engineers</td>
<td>5</td>
</tr>
<tr>
<td>or MATH 53 Ordinary Differential Equations with Linear Algebra</td>
<td></td>
</tr>
</tbody>
</table>

Select one of the following: 3-5

- CME 106/ ENGR 155C Introduction to Probability and Statistics for Engineers
- STAT 110 Statistical Methods in Engineering and the Physical Sciences
- STAT 116 Theory of Probability

Plus additional courses to total min. 24

#### Science

<table>
<thead>
<tr>
<th>Units</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>20 units minimum; see Basic Requirement</td>
<td>2</td>
</tr>
<tr>
<td>Plus additional required courses</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 31M Chemical Principles: From Molecules to Solids</td>
<td>5</td>
</tr>
</tbody>
</table>

#### Technology in Society

One course required; TIS courses should be selected from AA 252, BIOE 131, COMM 120W, CS 181, ENGR 117, ENGR 131, HUMBIO 174, ME 267, or MSE 193. 3-5

#### Engineering Fundamentals

Two courses minimum; see Basic Requirement 3

- ENGR 14 Intro to Solid Mechanics 3
- CS 106A Programming Methodology 3-5

### 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

<table>
<thead>
<tr>
<th>Units</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 161 Dynamic Systems, Vibrations and Control</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 105 Feedback Control Design</td>
<td>3</td>
</tr>
<tr>
<td>Pick one of:</td>
<td></td>
</tr>
<tr>
<td>ME 227 Vehicle Dynamics and Control</td>
<td>3</td>
</tr>
<tr>
<td>ME 327 Design and Control of Haptic Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Dynamic Systems and Controls Electives

<table>
<thead>
<tr>
<th>Units</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 171E Aerial Robot Design</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 205 Introduction to Control Design Techniques</td>
<td>3</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>ME 331A Advanced Dynamics &amp; Computation</td>
<td>3</td>
</tr>
<tr>
<td>ME 485 Modeling and Simulation of Human Movement</td>
<td>3</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Units</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 149 Mechanical Measurements</td>
<td>3</td>
</tr>
<tr>
<td>ME 151 Introduction to Computational Mechanics</td>
<td>5</td>
</tr>
<tr>
<td>ME 152 Material Behaviors and Failure Prediction</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Materials and Structures Electives

<table>
<thead>
<tr>
<th>Units</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 234 Introduction to Neuromechanics</td>
<td>3</td>
</tr>
<tr>
<td>ME 241 Mechanical Behavior of Nanomaterials</td>
<td>3</td>
</tr>
<tr>
<td>ME 281 Biomechanics of Movement</td>
<td>3</td>
</tr>
<tr>
<td>ME 283 Introduction to Biomechanics and Mechanobiology</td>
<td>3</td>
</tr>
</tbody>
</table>
Mechanical Engineering Undergraduate Major

**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 257 Gas-Turbine Design Analysis 3  
ME 351A Fluid Mechanics 3  
ME 352B Fluid Mechanics 3  
ME 352C Fundamentals of Heat Conduction 3  
ME 352D 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  

**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 257 Gas-Turbine Design Analysis 3  
ME 351A Fluid Mechanics 3  
ME 351B Fluid Mechanics 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

**Product Realization Concentration**
ME 127 Design for Additive Manufacturing 3  
ME 128 Computer-Aided Product Realization 3  
ME 129 Manufacturing Processes and Design (offered AY 19-20) 3  
**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 3-4  
or ME 298 Silversmithing and Design  
ME 309 Finite Element Analysis in Mechanical Design 3  
ME 324 Precision Engineering 4

**Units**

**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 257 Gas-Turbine Design Analysis 3  
ME 351A Fluid Mechanics 3  
ME 351B Fluid Mechanics 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

Math and science must total 45 units.

1. 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 STAT 110 Statistical Methods in Engineering and the Physical Sciences or STAT 116 is required).

2. 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 31M but at a slower pace. CHEM 31M is recommended.

3. ME 170A and ME 170B fulfill the WIM requirement.

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. If ME 151 is taken as an Engineering Core course, student must select a different M&S concentration course from the list of M&S electives.

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

**BSME 1.0 Notes**
Those students (primarily seniors) who are completing BSME 1.0 from AY 2017-2018 or earlier should refer to bulletins from the academic year that corresponds with their program sheet.

**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>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 14</td>
<td>Intro to Solid Mechanics</td>
<td>3</td>
</tr>
</tbody>
</table>

Stanford Bulletin 2019-20
ENGR 15        Dynamics                     3  
ME 1           Introduction to Mechanical Engineering  3  
ME 30          Engineering Thermodynamics        3  
ME 70          Introductory Fluids Engineering  3  
Plus two of the following:  
ME 80          Mechanics of Materials            3  
ME 103         Product Realization: Design and Making  4  
ME 104         Mechanical Systems Design        4  
ME 161         Dynamic Systems, Vibrations and Control  3  
Total Units: 21  

Thermosciences Minor  **  
ENGR 14        Intro to Solid Mechanics        3  
ME 30          Engineering Thermodynamics        3  
ME 70          Introductory Fluids Engineering  3  
ME 149         Mechanical Measurements         3  
ME 104         Mechanical Systems Design        4  
ME 132         Intermediate Thermodynamics       4  
ME 133         Intermediate Fluid Mechanics (offered SPR 18-19; more information to come)  3  
Total units: 22  

Mechanical Design Minor  ***  
ENGR 14        Intro to Solid Mechanics        3  
ENGR 15        Dynamics                        3  
ME 80          Mechanics of Materials          3  
ME 1           Introduction to Mechanical Engineering  3  
ME 102         Foundations of Product Realization  3  
ME 103         Product Realization: Design and Making  4  
Plus one of the following:  
ME 104         Mechanical Systems Design        4  
ME 210         Introduction to Mechatronics      4  
ME 127         Design for Additive Manufacturing  3  
ME 128         Computer-Aided Product Realization  3-4  
ME 129         Manufacturing Processes and Design  3  
ME 220         Introduction to Sensors          3-4  
Total units: 24-25  

* 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.