MECHANICAL ENGINEERING UNDERGRADUATE MAJOR

COVID-19-Related Degree Requirement Changes

For information on how Mechanical Engineering degree requirements have been affected by the pandemic, see the "COVID-19 Policies tab (http://exploredegrees.stanford.edu/schoolofengineering/mechanicalengineering/#covid19policiestext)" in the "Mechanical Engineering" of this bulletin. For University-wide policy changes related to the pandemic, see the "COVID-19 and Academic Continuity (http://exploredegrees.stanford.edu/covid-19-policy-changes/)" section of this bulletin.

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 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.

Core Requirements

		Units
Mathematics		
24 units minimum; see Basic Requirement 1 [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 [1]		
Plus addtional required courses [1]		
CHEM 31M	Chemical Principles: From Molecules to Solids	5
Technology in Society		
One course required; TIS courses should be selected from AA 252, BIOE 131, COMM 120W, CS 181, 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	5
or CS 106B	Programming Abstractions	
Engineering Core		
Minimum of 68 Engineering Science and Design ABET units; see Basic Requirement 5		
ME 1	Introduction to Mechanical Engineering	3
ENGR 15	Dynamics	3
ME 80	Mechanics of Materials	3
ME 30	Engineering Thermodynamics	3
ME 70	Introductory Fluids Engineering	3
ME 102	Foundations of Product Realization	3
ME 103	Product Realization: Design and Making	4
ME 104	Mechanical Systems Design	4
ME 131	Heat Transfer	4
ME 123	Computational Engineering	4
ME 170A	Mechanical Engineering Design- Integrating Context with Engineering [2,3]	4
ME 170B	Mechanical Engineering Design: Integrating Context with Engineering [2,3]	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. Up to 3 units of ME 191 Engineering Problems and Experimental Investigation may be petitioned to count as technical elective.

For students choosing the Materials and Structures concentration path, in addition to the 2 concentration-specific courses, students must select at least 2 courses from the Materials and Structures electives, in addition to courses from other concentrations, as technical electives.

		Units
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 (not offered AY21)	3
Dynamic Systems and Controls Electives		
ENGR 205	Introduction to Control Design Techniques	3
ME 210	Introduction to Mechatronics (not offered AY21)	4
ME 220	Introduction to Sensors	4
ME 331A	Advanced Dynamics & Computation (not offered AY21)	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 (not offered AY21)	3

		Units
Materials and Structures Concentration		
ME 149	Mechanical Measurements	3
ME 152	Material Behaviors and Failure Prediction	3
Materials and Structures Electives		
(2 M&S electives required for students in M&S concentration)		
AA 240	Analysis of Structures	3
MATSCI 198	Mechanical Properties of Materials	3-4
ME 234	Introduction to Neuromechanics (not offered AY21)	3
ME 241	Mechanical Behavior of Nanomaterials (not offered AY21)	3
ME 281	Biomechanics of Movement	3
ME 283	Introduction to Biomechanics and Mechanobiology (not offered AY21)	3
ME 287	Mechanics of Biological Tissues (not offered AY21)	4
ME 331A	Advanced Dynamics & Computation (not offered AY21)	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	Manufacturing Processes and Design (offered AY 19-20)	3
Product Realization Electives		
ENGR 110	Perspectives in Assistive Technology (ENGR 110)	1-2
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 (not offered AY21)	4
ME 263	The Chair	3-4
or ME 298	Silversmithing and Design	
ME 309	(not offered AY21)	3
ME 324	Precision Engineering	4

		Units
Thermo, Fluids, and Heat Transfer Concentration		
ME 149	Mechanical Measurements	3
ME 132	Intermediate Thermodynamics	4
ME 133	Intermediate Fluid Mechanics	3
Thermo, Fluids, and Heat Transfer Electives		
ME 257	Gas-Turbine Design Analysis (not offered AY21)	3
ME 351A	Fluid Mechanics	3
ME 351B	Fluid Mechanics	3
ME 352B	Fundamentals of Heat Conduction (not offered AY21)	3
ME 352C	Convective Heat Transfer (not offered AY21)	3
ME 352D	Nanoscale heat, mass and charge transport	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 31M but at a slower pace. CHEM 31M is recommended.

[2] ME 170A and ME 170B fulfill the WIM requirement. In AY 2020-21, the same grading basis applies to both ME 170A and ME 170B, and cannot be changed after week 8 of enrollment in ME 170A.

[3] ME 170A (http://exploredegrees.stanford.edu/search/?P=ME%20170A) and ME 170B (http://exploredegrees.stanford.edu/search/?P=ME%20170B) 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.

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:

		Units
General Minor *		
ENGR 14	Intro to Solid Mechanics	3
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 102	Foundations of Product Realization	3
ME 131	Heat Transfer	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 131	Heat Transfer	4
ME 132	Intermediate Thermodynamics	4
ME 133	Intermediate Fluid Mechanics (offered SPR 18-19; more information to come)	3
ME 149	Mechanical Measurements	3
Total units: 23		
Mechanical Design Minor ***		
ENGR 14	Intro to Solid Mechanics	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
ME 104	Mechanical Systems Design	4
Plus one of the following:		
ME 127	Design for Additive Manufacturing	3
ME 128	Computer-Aided Product Realization	3-4
ME 129	Manufacturing Processes and Design	3
ME 210	Introduction to Mechatronics	4
ME 220	Introduction to Sensors	3-4
Total units: 23		

* 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.