Mechanical Engineering

IN THE COLLEGE OF ENGINEERING

Design methodology and design projects are integrated throughout the curriculum, culminating in a capstone design experience in the senior year where students work on a design project as part of a design team.

The emphasis in bioengineering prepares students for employment in industry, or for higher professional degrees in bioengineering, engineering, or medicine.

In addition to the majors in mechanical engineering with the B.S. degree and emphasis in bioengineering, the department offers two BS/MS 4+1 degrees: The BS/MS 4+1 degree program with B.S. and M.S. in Mechanical Engineering and the BS/MS 4+1 degree program with B.S. in Mechanical Engineering and M.S. in Bioengineering. These degrees are for SDSU mechanical engineering students who wish to gain expertise in a specialization of mechanical engineering or bioengineering prior to employment in industry, government, or as preparation for further training.

Program Educational Objectives

The educational objectives of the mechanical engineering program are to prepare students who, after they graduate with a Bachelor of Science degree, are committed to:

1. Applying an open-minded but critical approach to the analysis of problems and the design of innovative and sustainable engineering solutions while employed in industry, government organizations, research and development, or in entrepreneurial efforts (professional practice);

2. Actively participating in ongoing professional development opportunities (professional development);

3. Conducting themselves responsibly, professionally, and ethically with a broad appreciation of the world and the role that engineering plays in society (service and citizenship).

Retention Policy

The engineering program expects all majors will make reasonable academic progress toward the degree. Engineering premajors who have either (1) completed major preparatory courses, earned 60 units, but have less than a 2.7 cumulative GPA; or (2) earned 60 units but have not completed major preparatory courses and/or have less than a 2.7 cumulative GPA may be removed from the premajor and placed in undeclared.

Impacted Program

The mechanical engineering major is an impacted program. To be admitted to the mechanical engineering major, students must meet the following criteria:

a. Complete with a grade of C (2.0) or better: Mechanical Engineering 200 [or Aerospace Engineering 200]; Chemistry 202 (or 200); Mathematics 150, 151, Physics 195, 196. These courses cannot be taken for credit/no credit (Cr/NC);

b. Have an overall cumulative GPA of 2.7.

To complete the major, students must fulfill the degree requirements for the major described in the catalog in effect at the time they are accepted into the premajor at SDSU (assuming continuous enrollment).

Major Academic Plans (MAPs)

Visit http://www.sdsu.edu/mymap for the recommended courses needed to fulfill your major requirements. The website was created to help students navigate the course requirements for their majors and to identify which General Education course will also fulfill a major preparation course requirement.

Mechanical Engineering Major

With the B.S. Degree

(Major Code: 09101) (SIMS Code: 447001)

The program below describes the 140 units required for the degree. Each course specifically listed in the program is required. In addition, the total number of units specified in each elective category represents a minimum requirement.
All students in mechanical engineering pursue a common program of basic sciences, engineering, and mechanical engineering fundamentals. Students are provided with the opportunity to select a pattern of study to satisfy their areas of interest. This pattern of study is indicated in the sequence known as “professional electives” and may be selected from available courses in controls, energy conversion, gas dynamics, heat transfer, machine design, materials, thermodynamics, vibrations, and other areas.

Students must complete all upper division courses in the major within seven years prior to graduation. Students who have completed any of those courses more than seven years before the projected date of graduation must contact the department chair for information about ways to certify knowledge of current course content.

Preparation for the Major. Mechanical Engineering 101, 102, 200 [or Aerospace Engineering 200], 202, 220 [or Aerospace Engineering 220], 240, 241; Aerospace Engineering 280; Biology 100 or 101; Chemistry 202 (or 200); Electrical Engineering 204; Mathematics 150, 151, 252; Physics 195, 195L, 196, 196L. Three to five upper division units to include Mechanical Engineering 304 (or Civil Engineering 301), 310, 314, 330, 350, 351, 452, 490A, 490B, 495, 520, 555; Aerospace Engineering 340, 341. Professional electives: Nine units of additional coursework may be selected from any 400- or 500-level mechanical engineering course, Aerospace Engineering 515, 535 [or Mechanical Engineering 535], or approved courses from other departments.

Master Plan. The master plan provides an advising record and a roadmap toward graduation for mechanical engineering majors. The master plan must be filed electronically with the mechanical engineering office (me@engineering.sdsu.edu). All students transferring to mechanical engineering from another institution are required to file the master plan at the time of transfer. Current SDSU students are required to file the master plan as part of their course requirements in Mechanical Engineering 102. Students are encouraged to seek the guidance of their faculty advisers when completing the master plan. If there is any change to the course sequence listed on a master plan that is already on file, it must be updated and refiled. All students must have an updated master plan on file in the department prior to enrollment in Mechanical Engineering 310. All course substitutions must be approved by the department chair prior to enrolling in such courses.

Emphasis in Bioengineering (SIMS Code: 447002)

The program below describes the 140 units required for the degree. Each course specifically listed in the program is required. In addition, the total number of units specified in each elective category represents a minimum requirement.

Preparation for the Major. Mechanical Engineering 101, 102, 200 [or Aerospace Engineering 200], 202, 220 [or Aerospace Engineering 220], 240, 241; Aerospace Engineering 280; Biology 203; Chemistry 202 (or 200); Electrical Engineering 204; Mathematics 150, 151, 252; Physics 195, 195L, 196, 196L. Three to five upper division units selected from: Biology 212, Chemistry 201, Chemistry 232 and Chemistry 232L, or Physics 197. (53-56 units)

The following courses: Chemistry 202 (or 200); Mathematics 150, 151; Physics 195, 196; Mechanical Engineering 200 [or Aerospace Engineering 200] must be completed with a grade of C (2.0) or better. These courses cannot be taken for credit/no credit (Cr/NC).

General Education. Students with this emphasis are required to take Biology 336 to satisfy three units of upper division Natural Sciences, IV.A.

Graduation Writing Assessment Requirement. Passing the Writing Placement Assessment with a score of 10 or completing one of the approved upper division writing courses (W) with a grade of C (2.0) or better. See “Graduation Requirements” section for a complete listing of requirements.

BS/MS 4+1 Degree Program

B.S. and M.S. in Mechanical Engineering (SIMS Code: 447012)

Students must complete 161 units to be simultaneously awarded the B.S. degree in mechanical engineering and the M.S. degree in mechanical engineering. Students can apply for admission to the BS/MS 4+1 (B.S. and M.S. in Mechanical Engineering) degree program when they have successfully completed a minimum of 90 units or a maximum of 115 units. These units must count towards one or the other of the two SDSU degree programs (BS or MS) that will ultimately be awarded in the dual degree program. All students must have a satisfactory score [minimum of 308 for combined verbal and quantitative on the Graduate Record Examination (GRE) General Test] and a minimum overall GPA of 3.0.

To satisfy the requirements for the BS/MS 4+1 degree program (B.S. and M.S. in Mechanical Engineering), students must achieve at least a 3.0 average in the 30 units of courses used to satisfy the graduate program of study. Of the 30 units, a maximum of nine units may be in 500-numbered mechanical engineering electives and all other program requirements must be satisfied. Three 500-level courses may be used to fulfill the elective requirements for the 4+1 BS/MS degree program (B.S. and M.S. in Mechanical Engineering) at the same time as serving as prerequisite courses for graduate study. The BS/MS 4+1 degree program (B.S. and M.S. in Mechanical Engineering) allows students to use any three 500-level M E courses toward their graduate degree. Students in the BS/MS 4+1 degree program (B.S. and M.S. in Mechanical Engineering) must follow the thesis option. Upon successful completion of the BS/MS 4+1 degree program, students will receive the B.S. degree in mechanical engineering and M.S. degree in mechanical engineering.

BS/MS 4+1 Degree Program

B.S. in Mechanical Engineering and M.S. in Bioengineering (SIMS Code: 447013)

Students must complete 161 units to be simultaneously awarded the B.S. degree in mechanical engineering and the M.S. degree in bioengineering. Students can apply for admission to the BS/MS 4+1 degree program (B.S. in Mechanical Engineering and M.S. in Bioengineering) when they have successfully completed a minimum of 90 units or a maximum of 115 units. These units must count towards one or the other of the two SDSU degree programs (BS or MS) that will ultimately be awarded in the dual degree program. All students must have a satisfactory score [minimum of 308 for combined verbal and quantitative on the Graduate Record Examination (GRE) General Test] and a minimum overall GPA of 3.0.

To satisfy the requirements for the BS/MS 4+1 degree program (B.S. in Mechanical Engineering and M.S. in Bioengineering), students must achieve at least a 3.0 average in the 30 units of courses used to satisfy the graduate program of study. Of the 30 units, a maximum of nine units may be in 500-numbered mechanical engineering electives and all other program requirements must be satisfied. Three 500-level courses may be used to fulfill the elective requirements for the BS/MS 4+1 degree program at the same time as serving as prerequisite courses for graduate study. For the BS/MS 4+1 degree program (B.S. in Mechanical Engineering and M.S. in Bioengineering) at the same time as serving as prerequisite courses for graduate study. The BS/MS 4+1 degree program (B.S. and M.S. in Mechanical Engineering) allows students to use any three 500-level M E courses toward their graduate degree. Students in the BS/MS 4+1 degree program (B.S. and M.S. in Mechanical Engineering) must follow the thesis option. Upon successful completion of the BS/MS 4+1 degree program, students will receive the B.S. degree in mechanical engineering and M.S. degree in mechanical engineering.
Mechanical Engineering

MS 4+1 degree program (B.S. in Mechanical Engineering and M.S. in Bioengineering). Upon successful completion of the BS/MS 4+1 degree program, students will receive the B.S. degree in mechanical engineering with an emphasis in bioengineering and M.S. degree in bioengineering.

Courses (M E)

Refer to Courses and Curricula and University Policies sections of this catalog for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.

LOWER DIVISION COURSES

M E 101. Solid Modeling I (2)

Six hours of laboratory.

Introduction to 3-D computer-aided mechanical design. Creation of basic to intermediate solid parts, assemblies, and drawings to include orthographic, pictorial, section, and detail views. Dimensioning, dimensional tolerancing, and thread notation per ASME Y14.5M-1994. CREO and SolidWorks software.

M E 102. Solid Modeling II (2)

Six hours of laboratory.

Prerequisite: Mechanical Engineering 101.


M E 200. Statics (3)

(Same course as Aerospace Engineering 200)

Prerequisites: Mathematics 150 and Physics 195 with a grade of C (2.0) or better in each course. Proof of completion of prerequisites required: Copy of transcript.

Force systems, equilibrium, structures, distributed forces, friction, virtual work, moments of inertia, vector algebra.

M E 202. Computer Programming and Applications (3)

Two lectures and three hours of activity.

Prerequisite: Mathematics 151.

Principles of programming using Matlab. Syntax topics to include arrays, control flow, data types, functions, and loops. Numerical methods to include curve fitting, Gauss reduction, interpolation, matrix operations, Newton-Raphson, numerical differentiation, and numerical integration. Matlab implementations. Application areas in mechanical engineering to include dynamic systems, finite element analysis, graphical user interfaces, and image analysis.

M E 220. Dynamics (3)

(Same course as Aerospace Engineering 220)

Prerequisites: Mechanical Engineering 200 [or Aerospace Engineering 200] and Mathematics 151 with a grade of C (2.0) or better in each course. Proof of completion of prerequisites required: Copy of transcript.

Kinetics of a particle; central force motion; systems of particles; work and energy; impulse and momentum; moments and products of inertia; Euler’s equations of motion; vibration and time response; engineering applications.

M E 240. Introduction to Engineering Materials (3)

Prerequisites: Chemistry 202 (or 200). Proof of completion of prerequisite required: Copy of transcript.

Atomic and molecular structure of materials utilized in engineering. Analysis of the relationships between structure of materials and their mechanical, thermal, electrical, corrosion, and radiation properties. Examples of material structure relevant to civil, electrical, aerospace, and mechanical engineering applications.

M E 241. Materials Laboratory (1)

Three hours of laboratory.

Prerequisite: Mechanical Engineering 240.

Experimental methods used to characterize engineering materials and their mechanical behavior.

M E 296. Experimental Topics (1-4)

Selected topics. May be repeated with new content. See Class Schedule for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor’s degree.

UPPER DIVISION COURSES

(Intended for Undergraduates)

NOTE: Proof of completion of prerequisites required for all Mechanical Engineering 300-, 400-, and 500-level courses: Copy of transcript.

M E 304. Mechanics of Materials (3)

Prerequisite: Mechanical Engineering 200 [or Aerospace Engineering 200].

Concepts of stress and strain. Generalized Hooke’s law. Formulations for axial, shear, bending, torsion, and combined stresses applied to tension members, pinned joints, beams, and shafts. Euler buckling criteria for columns. Energy methods. Not open to students with credit in Civil Engineering 301.

M E 310. Engineering Design: Introduction (3)

Two lectures and three hours of guided design activities.

Prerequisites: Mechanical Engineering 102, 202, and 220 [or Aerospace Engineering 220]. Every mechanical engineering student must have a master plan on file before enrolling in Mechanical Engineering 310.

Professional approach to engineering design problems. Problem definition, information gathering, feasibility studies, analysis, final design and communication. Several design studies and projects are completed.

M E 314. Engineering Design: Mechanical Components (3)

Prerequisites: Mechanical Engineering 102, 202, 241, 304 [or Civil Engineering 301].

Application of mechanics, physical properties of materials, and solid mechanics to the design of machine elements. Student design projects.

M E 330. Control Systems Laboratory (3)

Two lectures and three hours of laboratory.

Prerequisites: Mechanical Engineering 202, 220 [or Aerospace Engineering 220]; Electrical Engineering 204, Aerospace Engineering 280 and 340; Linguistics 200 or Rhetoric and Writing Studies 200; and Physics 196L.

Control theory (e.g. stability, feedback, PID control) with applications in microprocessor-based control of dynamic, vibrational, and mechatronic systems. “Bread-boarding” and BASIC programming of microcontrollers and graphical programming of PC-based controller interfaces.

M E 350. Thermodynamics (3)

Prerequisites: Mathematics 252 and Mechanical Engineering 200 [or Aerospace Engineering 200].

Basic concepts and principles of thermodynamics with emphasis on simple compressible substances. First and second law analysis, entropy, exergy analysis and state relations. Not open to students with credit in Mechanical Engineering 352.

M E 351. Engineering Thermodynamics (3)

Prerequisite: Mechanical Engineering 350.


M E 452. Principles of Heat Transfer (3)

Prerequisites: Mechanical Engineering 350 and Aerospace Engineering 340.

Analytical and numerical solutions of steady and transient one- and two-dimensional conduction problems, forced and natural convection in external and internal flows, and thermal radiation. Applications.
M E 490A-490B. Engineering Design: Senior Project (3-3)  
One lecture and four hours of guided design activities.  
Prerequisites for 490A: Mechanical Engineering 304 (or Civil Engineering 301), 310, 314, 452.  
Prerequisites for 490B: Mechanical Engineering 490A, 495.  
Applications of engineering principles and design techniques to the designing, building, and testing of an engineering system.  
A single project is completed in this two-course sequence and is judged completed upon presentation of an oral and a written report. In addition, issues related to ethics and engineering practice are discussed.

M E 495. Mechanical and Thermal Systems Laboratory (2)  
One lecture and three hours of laboratory.  
Prerequisites: Mechanical Engineering 310, 330, 351, 452.  
Data acquisition theory, instrumentation, sensors, data reduction, statistical and uncertainty analysis, and design of experiments.  
Experience in designing, performing, and reporting experiments on mechanical and thermal systems, mechanisms, vibrations, structures, thermodynamics, heat transfer.

M E 496. Advanced Mechanical Engineering Topics (1-3)  
Prerequisite: Consent of instructor.  
Modern developments in mechanical engineering. See Class Schedule for specific content. Maximum credit nine units for any combination of Mechanical Engineering 496, 499 and 596.

M E 499. Special Study (1-3)  
Prerequisite: Consent of instructor.  
Individual study. Maximum credit nine units for any combination of Mechanical Engineering 496, 499 and 596.

UPPER DIVISION COURSES  
(Also Acceptable for Advanced Degrees)  
NOTE: Proof of Completion of prerequisites required for all Mechanical Engineering 300-, 400-, and 500-level courses: Copy of transcript.

M E 520. Introduction to Mechanical Vibrations (3)  
Prerequisites: Mechanical Engineering 304 (or Civil Engineering 301) and Mechanical Engineering 330.  
Analysis of mechanical vibration; single- and multi-degree of freedom systems; free and forced vibrations; vibration isolation; vibration absorbers. Theory of vibration measuring instruments.

M E 530. Automatic Control Systems (3)  
Prerequisite: Mechanical Engineering 330.  
Dynamic characteristics of control components and systems. Stability and response of closed loop systems. Design of control systems.

M E 535. Mechanics of Composite Structures (3)  
(Same course as Aerospace Engineering 535)  
Prerequisites: Aerospace Engineering 280 and Aerospace Engineering 310 or Mechanical Engineering 314.  
Micro- and macro-mechanics of composite materials, classical lamination theory, initial failure prediction and progressive failure analysis of laminates, analysis of beam and plate structures, stiffness and strength based design of composites. Not open to students with credit in Mechanical Engineering 540.

M E 540. Nonmetallic Materials (3)  
Prerequisites: Mechanical Engineering 314.  

M E 543. Powder-Based Manufacturing (3)  
Prerequisite: Mechanical Engineering 240.  
Manufacturing of micro and nano-structured engineering components and composites starting with metal and/or ceramic powders. Powder production methods, characterization, powder shaping and compaction, sintering, hot consolidation, design considerations, and finishing operations.

M E 552. Heating, Ventilating, and Air-Conditioning (3)  
Prerequisites: Mechanical Engineering 351 and 452.  

M E 555. Energy and Thermal Systems Analysis and Design (3)  
Prerequisites: Mechanical Engineering 351 and 452.  
Analysis, design, and optimization of thermal systems using microcomputers. Modeling of thermal systems and components. Thermal system component characteristics and their effect on overall system performance. Relationship among thermal sciences in design process. Introduction to thermo-economic optimization.

M E 556. Solar Energy Conversion (3)  
Prerequisites: Mechanical Engineering 351, 452, and Aerospace Engineering 340.  
Application of thermodynamics, fluid mechanics and heat transfer to the thermal design of solar energy conversion systems. Computer simulations utilized.

M E 580. Biomechanics (3)  
Prerequisites: Mechanical Engineering 304 (or Civil Engineering 301) and Aerospace Engineering 340.  

One lecture and four hours of laboratory.  
Microfabrication techniques, microsensors and microactuators, and scaling laws. A design project of a micro-device including schematic creation, test of performance, layout generation, and layout versus schematic comparison.

M E 596. Advanced Mechanical Engineering Topics (1-3)  
Prerequisite: Consent of instructor.  
Modern developments in mechanical engineering. May be repeated with new content. See Class Schedule for specific content. Maximum credit of nine units for any combination of Mechanical Engineering 496, 499 and 596 applicable to a bachelor’s degree. Credit for 596 and 696 applicable to a master’s degree with approval of the graduate adviser.

GRADUATE COURSES  
Refer to the Graduate Bulletin.