

# Mechanical Engineering

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## ACADEMIC PROGRAMS

Mechanical Engineering – [BS](#), [MS](#)

### Mission Statement

To impart knowledge in the art and science of mechanical engineering through a comprehensive curriculum true to the traditional Cal Poly learn-by-doing philosophy that produces mechanical engineers of high ethics and skill, fully prepared for entry into industry, government, graduate school and private enterprise.

### Program Educational Objectives

A mechanical engineering graduate will:

- Be able to research, design, develop, test, evaluate, and implement engineering solutions to problems that are of a complexity encountered in professional practice.
- Be able to communicate and perform as an effective engineering professional in both individual and team-based project environments.
- Consider the ethical implications and societal impacts of engineering solutions.
- Continuously improve through lifelong learning.

### Program Description

The profession of mechanical engineering is directed toward the design, manufacture, and system integration of a very wide variety of equipment ranging from manufacturing machinery and power generation equipment to consumer goods. Of central concern to mechanical engineers is the

sound application of basic principles of solid mechanics, fluid mechanics and thermal sciences in the design, manufacture, and application of this equipment. Mechanical Engineering graduates obtain employment primarily with manufacturers, energy companies, consultants, and government agencies. Types of work performed by graduates include product design, mechanical design, testing, engineering management, engineering sales, design of manufacturing systems, and development of maintenance procedures. Mechanical Engineering graduates also often enhance their careers through graduate study in engineering, and some students also study engineering to build a scientific and technical foundation as a prelude to enrollment in medical, law, and business schools.

The focus of the Cal Poly Mechanical Engineering program is on education based on our "learn by doing" educational philosophy. Thus, the curriculum includes a large number of hands-on laboratories, integration of design throughout, and a senior project requirement for all students. Students are enrolled in engineering laboratories in all years of the curriculum. The program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (see page 158).

The Mechanical Engineering Department is the home of the Donald E. Bently Center for Engineering Innovation. The center provides support for faculty, students, and visiting scholars for the advancement of research, education, and practice in mechanical engineering. A \$6 million endowment to fund three professorships supports the center.

Upper division students in the **General Concentration** can choose professional elective courses from such courses as turbomachinery, robotics, mechatronics, composite materials, rotor dynamics, advanced mechanics, solar systems, internal combustion engines, heat and mass transfer, and courses emphasizing the petroleum, air conditioning, ventilating, and refrigeration industries. Students in the **Mechatronics Concentration** are prepared for professional practice in the design of "intelligent" products for use in factory automation, robotics, hybrid vehicles, alternate energy, and many other fields. The **HVAC&R Concentration** prepares students for careers in the heating, ventilating, air-conditioning and refrigeration (HVAC&R) industry, with a focus on the design of mechanical systems for commercial and industrial buildings.

There are six organized student clubs associated with the Mechanical Engineering Department. These are student chapters of the American Society of Mechanical Engineers, Society of Petroleum Engineers, Society of Automotive Engineers, American Society of Heating, Refrigerating and Air Conditioning Engineers, Alternative Energy Club, and the Pi Tau Sigma honorary society. All of these clubs offer students active programs in professional and leadership activities.

## Blended BS + MS Mechanical Engineering

The blended program provides motivated students with an accelerated route to the MS Mechanical Engineering, with simultaneous conferring of both bachelor's and master's degrees. Students in the blended program are provided with a seamless process whereby they can progress from undergraduate to graduate status. Up to two technical electives can be taken as an undergraduate and counted towards the master's degree.

### Eligibility

Students majoring in BS Mechanical Engineering may be eligible to pursue the blended program toward the MS Mechanical Engineering. Participation in the program is based on prior academic performance and other measures of professional promise, with a minimum GPA of 2.5 required, 3.0 recommended. Students are recommended for admission by a faculty committee. Please see 80 for eligibility criteria.

Two program options are available: **Thesis option.** 36 units of advisor-approved coursework, 9 units of thesis research/design, and an oral thesis defense examination. **Non-thesis option.** 45 units of advisor-approved coursework and a written comprehensive examination.

### Program Outcomes

#### BS Mechanical Engineering

The general program outcomes listed below are from our accrediting body, ABET. The 3 or 4 skills listed under each outcome were defined by the faculty in the ME program. Students who demonstrate proficiency in these skills satisfy the program outcomes.

#### A. An ability to apply knowledge of mathematics, science, and engineering

1. The student will be able to evaluate basic geometrical quantities and mathematical expressions.
2. The student will have knowledge of basic sciences and associated analysis techniques.
3. The student will be proficient with basic analyses associated with other disciplines.

#### B. An ability to design and conduct experiments, as well as to analyze and interpret data

1. The student will be proficient with the selection and basic operation of common instrumentation used in engineering measurement.
2. The student will be able to design and conduct an experiment and compare the results to those predicted by an analytical model.
3. The student will be able to interpret and discuss the results.

#### C. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social,

#### political, ethical, health and safety, manufacturability, and sustainability

1. The student will be able to recognize a need and develop appropriate design specifications.
2. The student will be able to develop component, system, or process concept solutions based on above specifications.
3. The student will be able to use analysis to refine the design of a component, a system, or a process.
4. The student will be able to build a functional prototype and assess if it meets performance specifications.

#### D. An ability to function on multidisciplinary teams

1. The student will recognize the value of a broad skill set resulting from a multidisciplinary team.
2. The student will be able to communicate effectively with colleagues in other disciplines.
3. The student will be able to identify when problems occur due to poor interactions among team members and identify ways to improve team dynamics.

#### E. An ability to identify, formulate, and solve engineering problems

1. The student will be able to identify faulty products or processes and develop an engineering solution.
2. The student will be able to select appropriate models for analyzing a system.
3. The student will be able to analyze their models and interpret their results.

#### F. An understanding of professional and ethical responsibility

1. The student will have knowledge of ASME code of ethics.
2. The student will be able to identify health and safety concerns associated with their design.
3. The student will be able to identify situations with ethical concerns.

#### G. An ability to communicate effectively

1. The student will be able to write an effective memorandum, letter, abstract, and project report.
2. The student will be able to give a coherent and effective oral presentation.
3. The student will be able to critique writing samples and oral presentations and identify both strong points and weak points in grammar, clarity, and organization.

#### H. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

1. The student will be aware of society's need for engineering solutions.
2. The student will be aware of the environmental and economic impact of their engineering solutions.
3. The student will be able to identify possible unintended negative global or societal consequences of proposed engineering solutions.

**I. A recognition of the need for, and an ability to engage in life-long learning**

1. The student will be able to understand the limitations of their knowledge.
2. The student will be able to find and use appropriate technical resources.
3. The student will be able to identify their need for additional education.

**J. A knowledge of contemporary issues**

1. The student will be able to identify important contemporary regional, national, or global issues.
2. The student will be able to discuss the historical roots of important contemporary regional, national, or local issues.
3. The student will be able to discuss ways engineers are contributing or might contribute to the solution of regional, national, or global problems.

**K. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice**

1. The student will be proficient with computer-based design simulation and analysis tools.
2. The student will be able to perform parametric studies of proposed designs.
3. The student will be able to develop a computer algorithm to solve a numerical problem.