MECHANICAL ENGINEERING

http://www.pacific.edu/Academics/Schools-and-Colleges/School-of-Engineering-and-Computer-Science/Academics-/Majors/Mechanical-Engineering-.html
Phone: (209) 946-2377
Location: Khoury Hall

Degrees Offered

Bachelor of Science in Mechanical Engineering

Program Educational Objectives

Through their careers in Mechanical Engineering or a related profession, Pacific BSME graduates are expected to demonstrate one or more of the following within a few years of earning their BSME:

- Competence via promotion to positions of increasing responsibility and/or leadership, publications, and/or conference presentations;
- Adaptability to new developments in science and technology in the workplace, pursuing graduate education in engineering and related fields, or participating in professional development activities;
- Creativity and innovation in engineering and technology through participation in activities such as research, design, intellectual property development, and/or entrepreneurial endeavors;

Pacific BSME graduates are also expected to pursue lifelong learning while demonstrating an awareness of humanistic, societal, and environmental issues through application of these concerns within their professional activities.

Student Outcomes Required to Achieve M.E. Program Educational Objectives

a. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
b. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors .
c. an ability to communicate effectively with a range of audiences
d. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
e. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
f. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
g. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Bachelor of Science in Mechanical Engineering

Students must complete a minimum of 120 units of academic work and a minimum of 32 units of Cooperative Education in order to earn the bachelor of science in mechanical engineering.

I. General Education Requirements

For more details, see General Education (http://catalog.pacific.edu/stocktongeneral/generaleducationprogram/)

Minimum 28 units and 9 courses that include:

A. CORE Seminars (2 courses)

CORE 001	Problem Solving & Oral Comm	3
CORE 002	Writing and Critical Thinking	4

Note: 1) CORE Seminars cannot be taken for Pass/No Credit. ***2)*** Transfer students with 28 or more transfer credits taken after high school are exempt from both CORE seminars.

B. Breadth Requirement (7 courses, at least 3 units each)

At least one course from each of the following areas:

- Artistic Process & Creation
- Civic & Global Responsibility
- Language & Narratives
- Quantitative Reasoning
- Scientific Inquiry
- Social Inquiry
- World Perspectives & Ethics

Note: 1) No more than 2 courses from a single discipline can be used to meet the Breadth Requirement.

C. Diversity and Inclusion Requirement

All students must complete Diversity and Inclusion coursework (at least 3 units)

Note: 1) Diversity and Inclusion courses can also be used to meet the breadth category requirements, or major or minor requirements.

D. Fundamental Skills

Students must demonstrate competence in:

- Writing
- Quantitative Analysis (Math)

Note: 1) Failure to satisfy the fundamental skills requirements by the end of four semesters of full-time study at the University is grounds for academic disqualification.

II. Major Requirements

Mathematics/Basic Science - Minimum 30 units that include:

MATH 051	Calculus I	4
MATH 053	Calculus II	4
MATH 055	Calculus III	4
MATH 057	Applied Differential Equations I: ODEs	4
PHYS 053	Principles of Physics I	5
PHYS 055	Principles of Physics II	5
Select one of the following for Chem Requirement:		4-5
AP CHEM scores of 4 or 5, or IB CHEM Higher Level scores of 5, 6, or 7		
CHEM 024	Fundamentals of Chem	
CHEM 025	General Chemistry	
CHEM 027	General Chemistry	

Mechanical Engineering Required Courses

ENGR 010	Dean's Seminar	1
ENGR 019	Computer Applications in Engineering	3
ENGR 020	Engineering Mechanics I (Statics)	3
ENGR 025	Professional Practice Seminar	1
ENGR 030	Engineering and Computing Ethics in Society	3
ECPE 041	Circuits	3
ECPE 041L	Circuits Laboratory	1
ENGR 045	Materials Engineering	3
ENGR 045L	Materials Engineering Lab	1
ENGR 120	Engineering Mechanics II (Dynamics)	3
ENGR 121	Mechanics of Materials	3
ENGR 122	Thermodynamics I	4
CIVL 130	Fluid Mechanics I	3
CIVL 130L	Fluid Mechanics I Lab	1
MECH 015	Mechanical Engineering Graphics	3
MECH 100	Manufacturing Processes	3
MECH 100L	Manufacturing Process Lab	1
MECH 120	Machine Design and Analysis I	4
MECH 129	Vibrations	4
MECH 140	Engineering Design/Senior Project I	4
MECH 141	Engineering Design/Senior Project II	4
Mechanical Electives Courses: A Minimum of 12 units of Mechanical Electives Courses are required, 3 of which may be non-MECH.		**12**
List of MECH Electives:		
MECH 104	Introduction to Mechatronics	
MECH 123	Kinematics and Dynamics of Machinery	
MECH 125	Machine Design and Analysis II	
MECH 150	Heat Transfer	
MECH 151	Applied Heat Transfer	
MECH 155	Solar Energy Engineering	
MECH 157	Thermodynamics II	
MECH 158	Air Conditioning	
MECH 160	Fluid Dynamics	
MECH 175	Systems Analysis and Control	
MECH 178	Finite Element Methods	
MECH 191	Independent Study	
MECH 197	Undergraduate Research	
MECH 200	Computer Aided Manufacturing	
MECH 202	Polymer and Composite Materials	
MECH 204	Advanced Mechatronics	
MECH 262	Combustion	
MECH 293	Special Topics	
List of Engineering Electives		
BENG 100 level courses; COMP 100 level courses; CIVL 100 level courses; ECPE 071/071L, and 100 level courses; EMGT 100 level courses, ENGR 100 level courses not list of ME required courses		
Cooperative Education - Minimum 32 units that include:		
ENGR 181	Professional Practice	1-16
ENGR 182	Professional Practice	1-16
ENGR 183	Professional Practice	1-16

Mechanical Engineering Courses

MECH 010. Introduction to Mechanical Engineering. 3 Units.
Students will be introduced to the many subdisciplines of Mechanical Engineering, future career paths, and what essential skill sets are needed for each subdiscipline. Students will learn how to work collaboratively and equitably in diverse groups. The ethics of working in groups in a mechanical engineering context will be discussed as students learn how to perform experimentation, technical writing skills, data analysis, statistics, and are trained on common instrumentation/apparatuses used by Mechanical Engineers.

MECH 015. Mechanical Engineering Graphics. 3 Units.
This course covers the principles and applications of graphics in engineering design. Topics include pictorial and isometric sketching and orthographic projection, the use of auxiliary views and sections, drafting standards and conventions, dimensioning and tolerances, in addition to layout and assembly drawings, detail drawings and production drawings with SolidWorks.

MECH 100. Manufacturing Processes. 3 Units.
This course is a study of traditional manufacturing processes such as formatting, cutting, joining, casting, and heat treating as well as advanced processing methods; manufacturing with polymers, composites, and ceramics in addition to metals, tribology, nondestructive evaluation, and quality control. Laboratory projects involve manufacturing skills, reverse engineering, automated machines, geometric dimensioning and tolerancing, and statistical process control. Prerequisites: Completion of all Fundamental Skills; MECH 015; and ENGR 045 or PDEP 046 with a "C-" or better. Corequisite: MECH 100L.

MECH 100L. Manufacturing Process Lab. 1 Unit.
Experimental analysis of concepts are discussed in MECH 100. Prerequisites: Completion of all Fundamental Skills; MECH 015; and ENGR 045 or PDEP 046 with a "C-" or better.

MECH 104. Introduction to Mechatronics. 3 Units.
A broad understanding of the main components of mechatronic systems; Understanding of the general principles involved in computer controlled machinery, including sensing, actuation and control; Practical knowledge of the development of simple embedded computer programs; Understanding of the practical application of mechatronic systems in applications such as manufacturing, automobile systems and robotics. Prerequisites: Completion of all Fundamental Skills and ENGR 019 with a "C-" or better.

MECH 120. Machine Design and Analysis I. 4 Units.
This course builds on fundamental principles learned in statistics, dynamics, and mechanics of materials, and applies them to the design and analysis of machines. Methods for performing load and stress analysis are learned along with analytical methods for solving deflection and stability problems. Static, impact, and fatigue failure theories for machines are also studied. Statistical methods for solving machine design problems are presented, and engineering design practices are integrated throughout the course. Prerequisites: Completion of all Fundamental Skills; ENGR 045, ENGR 120, ENGR 121; MECH 015 with a "C-" or better.

MECH 123. Kinematics and Dynamics of Machinery. 3 Units.
Students learn how to design, analyze and prepare a simulation of complex mechanisms with emphasis on high speed and precision applications. Topics include kinematics and dynamics of planar and three dimensional mechanisms; gyroscopic forces in machines and balancing, and applications to robotics. Prerequisites: Completion of all Fundamental Skills; ENGR 120 and ENGR 121 with a "C-" or better.

MECH 125. Machine Design and Analysis II. 3 Units.
Students learn how to design, analyze, and incorporate a variety of standard parts and devices into machines. These parts and devices include fasteners, gear systems, belt drives, chain drives, shafts, couplings, bearings, springs, clutches, and brakes. Principles of tribology (friction, wear, and lubrication) are introduced and applied to the design of machines. Engineering design practices are integrated throughout the course. Prerequisites: Completion of all Fundamental Skills and MECH 120 with a "C-" or better.

MECH 129. Vibrations. 4 Units.
Students study models of physical systems with lumped and distributed parameters. The studies include free and forced vibrations of machines and structures as well as excitation and response of single degree of freedom systems. The course introduces multiple degrees of freedom systems, finite element formulations and mode superposition techniques. Prerequisites: ENGR120, MATH 057, ENGR 019 with a "C-" or better.

MECH 140. Engineering Design/Senior Project I. 4 Units.
This course discusses methods of initiating, planning, conceptualizing, and configuring engineering designs. The student uses these methods to develop an engineering design for a product or process that involves mechanical engineering. Product realization methods, project management, materials selection, design thinking, rapid prototyping, manufacturing for designers, guided iteration, communication skills, economics, ethics, liability, and safety issues are put into practice through class activities. Prerequisites: Completion of all Fundamental Skills; ENGR 122 with a "C-" or better; and Prerequisite that may be taken concurrently: MECH 120 or MECH 150 with a "C-" or better.

MECH 141. Engineering Design/Senior Project II. 4 Units.
The student completes the design phase of their project. Guided iteration and optimization are used to complete the detailed design of a product or process involving mechanical engineering. Manufacturing and rapid prototyping are used to complete the fabrication of a product or process. Failure modes and effects analysis, safety, and liability are considered. Regular oral and written progress reports are required along with final comprehensive oral and written reports. Prerequisites: Completion of all Fundamental Skills; MECH 100 and MECH 140 with a "C-" or better.

MECH 150. Heat Transfer. 3 Units.
Students study heat transfer by conduction in one, two and three dimensions in transient and steady state and heat transfer in extended surfaces. Topics include solutions by numerical methods and simulation techniques, convection in external and internal flow, free convection, and radiation. Prerequisites: Completion of all Fundamental Skills; ENGR 122 and MATH 057 with a "C-" or better.

MECH 151. Applied Heat Transfer. 3 Units.
Applications and extensions of the topics in MECH 150. Multimode heat transfer; heat exchangers. Heat transfer with phase change. Prerequisites: Completion of all Fundamental Skills and MECH 150 with a "C-" or better.

MECH 155. Solar Energy Engineering. 3 Units.
This course introduces students to solar energy, sun-earth geometry, radiation measurement, insulation on surfaces, principles of solar collectors, applications such as space heating and solar ovens, and photovoltaics. Laboratory experiments are included. Prerequisites: Completion of all Fundamental Skills and ENGR 122 with a "C-" or better.

MECH 157. Thermodynamics II. 3 Units.
Students examine the thermodynamics of cycles for power and refrigeration. Other topics include the thermodynamics of gas mixtures, chemical reactions, chemical equilibrium, combustion, fuels, and processes involving air and water mixtures relating to heating, cooling, and ventilating for human comfort. The course includes experimental activities and written laboratory reports. Prerequisites: Completion of all Fundamental Skills and ENGR 122 with a "C-" or better.

MECH 158. Air Conditioning. 3 Units.
Students are introduced to air conditioning purpose, terminology and typical systems. Students study the analysis and design of air conditioning as applied to residential and small commercial buildings, and they learn the codes and standards applicable to this field. Prerequisites: Completion of all Fundamental Skills; ENGR 122 with a "C-" or better.

MECH 160. Fluid Dynamics. 3 Units.
Students study equations of continuity, energy, and momentum as applied to fluid flow. Topics include one dimensional compressible flow, and the introduction to more advanced topics, such as turbomachinery, viscous flow and potential flow. Prerequisites: Completion of all Fundamental Skills; CIVL 130 and ENGR 122 with a "C-" or better.

MECH 175. Systems Analysis and Control. 3 Units.
Students study dynamic analysis and control of systems composed of mechanical, electrical, hydraulic and thermal components. Students use of system modeling and simulation techniques to predict transient and steady state response, lumped parameter approximations and linearization. Students also use feedback to enhance system performance and stability and they study design of linear control systems in the time and frequency domains. Prerequisites: Completion of all Fundamental Skills; ECPE 041, ECPE 041L, MECH 129 with a “C-“ or better.

MECH 178. Finite Element Methods. 3 Units.
This course introduces the finite element method for engineering problems. Topics include matrix formulation of finite element models for problems in solid mechanics, heat transfer and fluid flow as well as solution of finite element equilibrium equations. Students study the development of computer algorithms and applications that use commercial finite element computer programs. Some familiarity with matrix methods is desirable. Prerequisites: Completion of all Fundamental Skills; ENGR 121 and ENGR 122 with a "C-" or better. Prerequisite, may be taken concurrently: CIVL 130 with a "C-" or better.

MECH 191. Independent Study. 1-4 Units.
Special individual projects are undertaken under the direction of one or more faculty members knowledgeable in the particular field of study. Permission of department chairperson and faculty members involved.

MECH 197. Undergraduate Research. 1-4 Units.
This course includes applied or basic research in mechanical engineering under faculty supervision. Projects may be experimental, mathematical or computational in nature. Permission of faculty supervisor and department chairperson. Student must be in good academic standing.