

# Mechanical Engineering

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<https://engineering.temple.edu/academics/departments/mechanical-engineering-department>

The Mechanical Engineering Program is accredited by the Engineering Accreditation Commission (EAC) of ABET, <http://www.abet.org>.

## Program Goals, Objectives & Design Integration

The mission of the Mechanical Engineering Department is to provide an excellent educational experience for the students in its programs. This experience includes an emphasis on the technical, communication, and teamwork skills that graduate engineers need to succeed, in both the workplace and society in general. In order to achieve these goals, the department places great importance on teaching, research, scholarship, engineering practice, and service to the university community and the Engineering profession. The mechanical engineering program is structured to prepare the graduate for the professional practice of engineering and/or graduate school. The curriculum emphasizes a rigorous treatment of the mathematical and scientific approach to the solution of engineering problems. It provides a coherent set of courses in energy conversion and structures/motion in mechanical systems. The program has design across the curriculum and is capped with an integrated design experience in the form of a senior project.

## Programs

- Bachelor of Science in Mechanical Engineering (<http://bulletin.temple.edu/undergraduate/engineering/mechanical-engineering/bs-mechanical-engineering>)
- Bachelor of Science in Mechanical Engineering with Co-op (<http://bulletin.temple.edu/undergraduate/engineering/mechanical-engineering/bs-mechanical-engineering-cooperative-education>)

## Courses

### **MEE 0843. Technology Transformations. 3 Credit Hours.**

Expand your knowledge by looking at how various technologies such as electricity, automobiles, airplanes, telephones, bridges, highways, electronics, computers, and information technology have transformed the world around us. What would we do without them? Where do they come from? How do they work? Technology is developed by people who have the ideas, design the machines and processes, and suffer the costs and benefits of technological changes in our society. Learn about science and technology through history of discovery, invention and innovation through lectures and labs. We will also study several promising fields which may lead us to the future of technology. NOTE: This course fulfills a Science & Technology (GS) requirement for students under GenEd and Science & Technology Second Level (SB) for students under Core.

**Course Attributes:** GS

**Repeatability:** This course may not be repeated for additional credits.

### **MEE 0844. The Bionic Human. 3 Credit Hours.**

Can we replace our "worn-out" body parts with space-age materials? Will the day come when an injured athlete buys a tendon for the next big game? Why are your parents spending so much time at the doctor? We are on the verge of building "the bionic human" by repairing many of our body parts indefinitely. Become familiar with bio-engineered technologies for age-, disease-, sports-, and accident-related injuries. Learn why weight bearing exercise strengthens bones, the difference between MRI, CAT scan, and X-Ray, and what the folks at the Food and Drug Administration do. By the time you finish this course, you'll know how a pig heart could save your life, how stem cell research could affect your future, the purpose of animal testing, and why walking through airport security could be a problem if you have had your hip replaced. NOTE: This course fulfills a Science & Technology (GS) requirement for students under GenEd and Science & Technology Second Level (SB) for students under Core. Students cannot receive credit for this course if they have successfully completed MEE 0944, BIOE 0844 or BIOE 0944.

**Course Attributes:** GS

**Repeatability:** This course may not be repeated for additional credits.

**MEE 0944. Honors Bionic Human. 3 Credit Hours.**

From MRIs to engineered organs, modern healthcare has become synonymous with applications of bioengineering and technology. This course focuses on the new bioengineering paradigm, exploring the ways in which disciplines intersect to produce advances in healthcare. A key goal is to enable students to make more informed decisions about healthcare based on their understanding not only of technological advancements but of the ethical and societal issues arising as a consequence. This discovery-based seminar includes interactive lectures, hands-on and virtual labs, discussion, research and presentations. NOTE: This course fulfills a Science & Technology (GS) requirement for students under GenEd and Science & Technology Second Level (SB) for students under Core. Students cannot receive credit for this course if they have successfully completed MEE 0944, BIOE 0844 or BIOE 0944.

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR.

**Course Attributes:** GS, HO

**Repeatability:** This course may not be repeated for additional credits.

**MEE 1001. Introduction to Mechanical Engineering. 2 Credit Hours.**

Provides an understanding of the study and practice associated with mechanical engineering and technology disciplines. Understand the importance of good communications and teamwork skills in a successful engineering and technology career. Understand the basics of problem solving and design. Discipline-specific labs.

**Repeatability:** This course may not be repeated for additional credits.

**MEE 1019. Automotive Design I. 1 Credit Hour.**

Design of automotive chassis, suspension, and drive train for participation in Society of Automotive Engineers competitions. Grade based on participation (50%) and/or design report (50%).

**Repeatability:** This course may not be repeated for additional credits.

**MEE 1029. Automotive Design II. 1 Credit Hour.**

Continuation of MEE 1019 (0180). Grade based on participation (50%) and/or design report (50%).

**Repeatability:** This course may not be repeated for additional credits.

**MEE 1039. Automotive Design III. 1 Credit Hour.**

Continuation of MEE 1029 (0181). Grade based on participation (50%) and/or design report (50%).

**Repeatability:** This course may not be repeated for additional credits.

**MEE 2011. Linear Systems. 3 Credit Hours.**

This course introduces junior-level engineering students to linear-systems analysis and numerical methods in engineering. Numerical-analysis procedures typically encountered in the upper-level mechanical-engineering curriculum are considered and include: linear matrix equations and their solutions, eigenvalue problems, numerical interpolation, differentiation and integration, and the numerical solution of differential equations.

**Field of Study Restrictions:** Must be enrolled in one of the following Fields of study: Bioengineering, Civil Engineering, Mechanical Engineering.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(MATH 1042|Minimum Grade of C-|May not be taken concurrently  
OR MATH 1942|Minimum Grade of C-|May not be taken concurrently)  
AND (MATH 2043|Minimum Grade of C-|May be taken concurrently  
OR MATH 2943|Minimum Grade of C-|May be taken concurrently)  
AND (MATH 3041|Minimum Grade of C-|May not be taken concurrently  
OR MATH 3941|Minimum Grade of C-|May not be taken concurrently)

**MEE 2305. Measurements & Dynamics Laboratory. 1 Credit Hour.**

Basic measurements and measurement principles. Experiments and simulations of static and dynamic systems. Statistical analysis of results, written reports and journals.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

ENGR 2332|Minimum Grade of C-|May be taken concurrently  
OR ENGT 3323|Minimum Grade of C-|May be taken concurrently.

**MEE 3301. Machine Theory and Design. 3 Credit Hours.**

Course includes design process, statistical method, stress and deflection, materials, failure criteria from static and dynamic loadings. Analysis of mechanical components including screws, welded parts, gears, belts and shafts. Team design projects with written reports and presentations.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(ENGR 1117|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 2332|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 2333|Minimum Grade of C-|May not be taken concurrently)  
OR ENGR 2933|Minimum Grade of C-|May not be taken concurrently)

**MEE 3302. Kinematics of Mechanisms. 3 Credit Hours.**

This course builds on the concepts of kinematics first presented in sophomore level Dynamics and explores its application to mechanical design. Starting with an introduction to links, joints and kinematic chains, students will learn the analysis and design of spatial mechanisms with an emphasis on position, velocity and acceleration of linkages. In addition to graphical and numerical analysis, computer aided mechanism design will be performed using SolidWorks Motion.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

ENGR 2332|Minimum Grade of C-|May not be taken concurrently.

**MEE 3305. Materials Laboratory. 1 Credit Hour.**

Laboratory experiments related to the nature and properties of materials, including: stress, strain, fractures, microstructure, metallography, and nondestructive testing.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(ENGR 2333|Minimum Grade of C-|May not be taken concurrently)  
OR ENGR 2933|Minimum Grade of C-|May not be taken concurrently)  
OR ENGT 2322|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 3496|Minimum Grade of C-|May be taken concurrently)  
OR ENGR 3201|Minimum Grade of C-|May be taken concurrently)  
OR ENGT 3396|Minimum Grade of C-|May be taken concurrently)  
OR ENGT 3201|Minimum Grade of C-|May be taken concurrently)  
AND (MEE 2305|Minimum Grade of C-|May be taken concurrently)

**MEE 3421. Dynamic Systems. 3 Credit Hours.**

A study of the dynamic response of physical systems, concentrating on mechanical systems in translation, rotation, and combined motion. Mathematical models are developed using interacting elements, inter-connecting laws, and physical laws. Both the state variable and input-output analysis are considered. Solutions for the model response include using the following techniques: analytical, Laplace Transform, transfer function, matrix methods, and numerical analysis. Design project.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(ENGR 2332|Minimum Grade of C-|May not be taken concurrently)  
AND (MEE 2011|Minimum Grade of C-|May not be taken concurrently)  
OR MATH 2101|Minimum Grade of C-|May not be taken concurrently)  
AND (MATH 3041|Minimum Grade of C-|May not be taken concurrently)  
OR MATH 3941|Minimum Grade of C-|May not be taken concurrently)

**MEE 3506. Fluid Mechanics Laboratory. 1 Credit Hour.**

This laboratory aims to familiarize the students with different data acquisition techniques and devices to measure and control the behavior of various fluid systems. Experiments will include pressure and velocity measurements as well as modern transducers and pressure/flow regulators.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

ENGR 3553|Minimum Grade of C-|May be taken concurrently  
OR ENGT 2521|Minimum Grade of D-|May be taken concurrently.

**MEE 4040. Special Topics. 1 to 4 Credit Hour.**

A course designed to present new and emerging areas of engineering. The course may also be used to present areas not normally taught in the College. Course requirements vary with the topic and instructor. Offered as needed or as appropriate.

**Class Restrictions:** Must be enrolled in one of the following Classes: Junior 60 to 89 Credits, Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits.

**Repeatability:** This course may be repeated for additional credit.

**MEE 4173. Data Acquisition and Analysis for Engineers. 3 Credit Hours.**

Course content includes the use of microcomputers for automated data acquisition, process control, and data analysis. The principles and applications of sensors, transducers, recording instruments, signal conditioning, and control instrumentation, and sampling theory. Data analysis using Fourier transform and least squares method. Computer software development for interfacing and graphics. Hands-on lab and design project required.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(MATH 2101|Minimum Grade of C-|May not be taken concurrently)  
OR MEE 2011|Minimum Grade of C-|May not be taken concurrently)  
AND (MEE 2305|Minimum Grade of C-|May not be taken concurrently)  
AND (ECE 2112|Minimum Grade of C-|May not be taken concurrently)

**MEE 4191. Independent Research in Mechanical Engineering. 2 to 5 Credit Hours.**

Arranged each semester, please consult with the instructor.

**Repeatability:** This course may be repeated for additional credit.

**MEE 4311. Mechanics of Composite Materials. 3 Credit Hours.**

Introduction to the behavior of composite materials and their use in engineering structures: behavior and properties of the constituent fibers and matrices, micromechanical predictions of composite properties, anisotropic elasticity, behavior of composite laminae, classical lamination theory; fracture mechanisms, failure theories; behavior of composite plates and beams.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(ENGR 2333|Minimum Grade of C-|May not be taken concurrently)  
OR ENGR 2933|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 3496|Minimum Grade of D-|May not be taken concurrently)  
OR ENGR 3201|Minimum Grade of D-|May not be taken concurrently)  
AND (MATH 2101|Minimum Grade of C-|May not be taken concurrently)  
OR MEE 2011|Minimum Grade of C-|May not be taken concurrently)  
AND (MATH 3041|Minimum Grade of C-|May not be taken concurrently)  
OR MATH 3941|Minimum Grade of C-|May not be taken concurrently)

**MEE 4382. Independent Study in Mechanical Engineering. 1 to 6 Credit Hour.**

Arranged each semester, please consult with the instructor.

**Repeatability:** This course may be repeated for additional credit.

**MEE 4405. Vibrations Laboratory. 1 Credit Hour.**

This course covers instrumentation and data acquisition of single degree of freedom, multi-degree of freedom, and continuous vibratory systems. It also covers data analysis software in time domain and frequency domain, simulation of basic vibratory systems, and statistical analysis of results.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

MEE 4422|Minimum Grade of D-|May be taken concurrently.

**MEE 4411. Introduction to Mobile Robotics. 3 Credit Hours.**

How can one create mobile robots that operate autonomously in cluttered indoor and outdoor environments? How do robots determine their state and properties from noisy sensor data to accomplish navigation and manipulation tasks? The Introduction to Mobile Robotics course will address motion planning and control software modules for robotic systems. Students taking this course are expected to be familiar with differential equations, linear algebra, and multi-variable calculus. Experience with programming in Matlab or Octave is recommended (and Matlab will be used in this course).

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(MEE 2011|Minimum Grade of C-|May not be taken concurrently)  
AND (MEE 3421|Minimum Grade of C-|May not be taken concurrently)

**MEE 4422. Mechanical Vibrations. 3 Credit Hours.**

The study of single degree, two degrees, and multi-degrees of freedom systems, harmonic and non-harmonic excitation, damped and undamped response, free, forced, transient, and random vibrations, resonance beating, force transmission, isolation, base, and self excitation. Term design project. Computer numerical methods.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

MEE 3421|Minimum Grade of D-|May not be taken concurrently.

**MEE 4506. Energy Conversion Laboratory. 1 Credit Hour.**

This laboratory will emphasize advanced measurement techniques in energy systems. Computer based data acquisition and statistics are integral parts of the course. Experiments will include: gas and liquid measurements, heat and mass transfer, and engine measurements.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(ENGR 3553|Minimum Grade of C-|May not be taken concurrently)  
OR ENGR 3953|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 3571|Minimum Grade of C-|May not be taken concurrently)  
AND (MEE 3506|Minimum Grade of C-|May not be taken concurrently)  
AND (MEE 4571|Minimum Grade of D-|May be taken concurrently)  
AND (MEE 4572|Minimum Grade of D-|May be taken concurrently)

**MEE 4512. Compressible Fluid Dynamics. 3 Credit Hours.**

This course will introduce students to the subject of high speed gas dynamics. Compressible flows exhibit fundamentally different behavior from that observed in low speed, constant density fluids. Such flows are found in aerodynamics, combustors, turbines, jets, gas pipelines, and wind tunnel test facilities. Students will study phenomena associated with supersonic flows, including normal and oblique shocks, expansion fans, and compressible flows with friction and/or heat transfer. An introduction to high temperature and rarefied gas dynamics will also be included.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(ENGR 3553|Minimum Grade of C-|May not be taken concurrently)  
OR ENGR 3953|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 3571|Minimum Grade of C-|May not be taken concurrently)

**MEE 4513. Aerodynamics. 3 Credit Hours.**

The forces and moments exerted by moving fluids on solid bodies are of concern in numerous applications. While the performance of flight vehicles is of particular interest, aerodynamics is also a subject of importance in passenger and race car design, wind turbines, structures, sea vessels, etc. Students will study various topics in low speed aerodynamics, including thin airfoil theory and airfoil nomenclature, finite wing theory, high lift and drag reduction devices, separated and vortical flows, and rotating blades. An introduction to transonic flows and computational aerodynamics will also be included.

**Field of Study Restrictions:** Must be enrolled in one of the following Fields of study: Civil Engineering, Mechanical Engineering.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

ENGR 3553|Minimum Grade of C-|May not be taken concurrently  
OR ENGR 3953|Minimum Grade of C-|May not be taken concurrently.

**MEE 4571. Advanced Thermodynamics and Combustion. 3 Credit Hours.**

Review of basic concepts, first and second laws, entropy (statistical and classical), power and refrigeration cycles, thermodynamic relationships, mixtures, chemical reactions and equilibrium, introduction to combustion process. Term design project.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

ENGR 3571|Minimum Grade of C-|May not be taken concurrently.

**MEE 4572. Heat and Mass Transfer. 3 Credit Hours.**

Principles and applications of heat transfer by conduction, convection, and radiation processes. Combined modes of heat transfer. Graphic and numerical solutions. Steady and unsteady as well as multi-dimensional conduction heat transfer. Forced and free convection. Heat exchanger theory. Introduction to radiation. Term design project. Computer Numerical methods.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(MATH 3041|Minimum Grade of C-|May not be taken concurrently  
OR MATH 3941|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 3571|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 3553|Minimum Grade of C-|May not be taken concurrently)  
OR ENGR 3953|Minimum Grade of C-|May not be taken concurrently)

**MEE 4573. Internal Combustion Engines. 1 Credit Hour.**

Types of engines, design considerations, combustion, friction, emission.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

MEE 4571|Minimum Grade of D-|May be taken concurrently.

**MEE 4574. Heating, Ventilating, and Air Conditioning. 3 Credit Hours.**

Course content includes human comfort criteria, heating and cooling loads, HVAC system types, room air distribution, terminal unit selection, fans and ducts, pumps and piping, computer-aided design; term design project.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(ENGR 3571|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 3553|Minimum Grade of C-|May not be taken concurrently)  
OR ENGR 3953|Minimum Grade of C-|May not be taken concurrently)

**MEE 4575. Renewable and Alternative Energy. 3 Credit Hours.**

Current state of renewable and alternative energy; different scenarios of producing energy: mechanical heat engines, ocean thermal energy converters, thermoelectricity, solar radiation, biomass, photovoltaic converters, wind energy, and ocean engines; design of hydrogen-powered systems: polymer electrolyte membrane fuel cells.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

ENGR 3571|Minimum Grade of C-|May not be taken concurrently.

**MEE 4576. Photovoltaic System Design for Engineers. 3 Credit Hours.**

The course will introduce students to the photovoltaic system design. It will begin by providing a basic understanding of the properties of sunlight, review the relevant semiconductor concepts and provide an in-depth understanding of the principles governing conventional solar cell operation. Focus will then be placed on the intricacies of solar cell design exploring such aspects as module fabrication, standalone and grid-connected system requirements, and photovoltaic material specific issues. The remainder of the course will be devoted to requirements, design and economics of specific purpose photovoltaic applications.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

ENGR 3571|Minimum Grade of C-|May not be taken concurrently.

**MEE 4577. Power Generation and Storage Technologies. 3 Credit Hours.**

This course will give an overview of electric power generation technologies including coal, gas, and nuclear power plants, as well as some emerging technologies such as photovoltaic. This course will also discuss technologies used in power transmission and distribution such as overhead power line conductors. Power storage technologies will also be introduced, including compressed air, flywheel, hydrogen, and batteries.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(ENGR 3571|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 3201|Minimum Grade of C-|May be taken concurrently)  
AND (ENGR 3553|Minimum Grade of C-|May not be taken concurrently)  
OR ENGR 3953|Minimum Grade of C-|May not be taken concurrently)

**MEE 4643. Manufacturing Engineering. 3 Credit Hours.**

A course designed to present new and emerging areas of Manufacturing Engineering. This course covers manufacturing processes under the classification of processing operations and the assembly operations, and the parameters involved in these processes. The course is combination of lectures and intensive lab activities such as machining, welding, 3-D printing.

**Field of Study Restrictions:** Must be enrolled in one of the following Fields of study: Mechanical Engineering.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

MEE 3301|Minimum Grade of D-|May not be taken concurrently.

**MEE 4731. Cardiovascular Fluid Dynamics. 3 Credit Hours.**

Mechanics of blood circulation, fluid mechanics of the heart, blood flow in arteries, unsteady flow in veins, current concepts in circulatory assist devices, biofluidics, and other selected topics.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

ENGR 3553|Minimum Grade of C-|May not be taken concurrently  
OR ENGR 3953|Minimum Grade of C-|May not be taken concurrently.