

MECHANICAL ENGINEERING (MENG)

MENG 1001 - Introduction to Aerospace & Mechanical Engineering **Credit(s): 1 Credit**

This course will introduce aerospace and mechanical engineering. Through hands-on activities, students will learn the basics of engineering design and entrepreneurship. Working in teams, students will build aerospace and mechanical systems, practice entrepreneurial thinking, and develop the personal and professional skills needed to engage in lifelong learning. This course is open to non-majors.

MENG 1002 - Computer-Aided Engineering Design **Credit(s): 1 Credit**

This course is an introduction to engineering drawing and computer aided design (CAD) and 3D solid modeling. Students will learn to interpret engineering drawings, create engineering drawings, and create 3D models of mechanical systems.

MENG 2000 - Foundation to Engineering Design **Credit(s): 3 Credits**

Introduction to engineering, design philosophy, design methodology, design process, human factors, ethics, and economics. Various case studies will be presented to understand the principles of engineering. This course would prepare a student to think creatively in other engineering courses. Aided Eng. Design.

Prerequisite(s): PHYS 1610* and MENG 1002*

* Concurrent enrollment allowed.

MENG 2011 - Engineering Shop Practice **Credit(s): 1 Credit**

MENG 2300 - Applied Thermodynamics **Credit(s): 3 Credits**

This course is an extension of the course on Thermodynamics. A detailed study on cycle analysis is included. Applications to compressors, turbines, heat pump, refrigeration and air-conditioning are emphasized. A design, comparison and evaluation of several design cycles is included.

Prerequisite(s): ESCI 2300

MENG 2600 - Manufacturing Process **Credit(s): 3 Credits**

This course provides detailed discussion on various manufacturing processes: netshape, material removal, and joining and assembly processes. Students learn the fundamental principles and the tools-of-the-trade by working hand-on with the machine tools. The current manufacturing techniques such as rapid prototyping, manufacturing cells, and lean-manufacturing are discussed.

Prerequisite(s): MENG 2011

MENG 2910 - Co-Op with Industry **Credit(s): 0 Credits (Repeatable for credit)**

A full-time supervised work experience with an agency, firm or organization that employs persons in this degree field. This course is used for the first experiential learning session. Grading system is determined by department offering course.

Restrictions:

Students with a semester level of Freshman may **not** enroll.

MENG 2913 - Co-Op in Mechanical Engineering

Credit(s): 0 Credits (Repeatable for credit)

An optional supervised work experience with an agency, firm, or organization which employs engineers. The student receives a Pass or No Pass grade.

MENG 2930 - Special Topics

Credit(s): 3 Credits (Repeatable for credit)

MENG 2980 - Independent Study

Credit(s): 1 or 3 Credits (Repeatable for credit)

MENG 3001 - Mechanical Engineering Lab

Credit(s): 1 Credit

Prerequisite(s): MENG 3430* ; MENG 3510*

* Concurrent enrollment allowed.

MENG 3010 - Machine Design

Credit(s): 3 Credits

Design methodology, optimization, design of various machine elements including shafts, springs, belts, gears, and bearing. Design for strength and rigidity, fatigue and fracture.

Prerequisite(s): AENG 3100*

* Concurrent enrollment allowed.

MENG 3100 - Computer Aided Engineering

Credit(s): 3 Credits

The course outlines the principles of Computer Aided Engineering. The computer applications to structural design, kinematic synthesis and design optimization are explored.

Prerequisite(s): (ESCI 310 and CSCI 145)

MENG 3430 - Measurements

Credit(s): 3 Credits

A study of various measurement techniques in engineering and statistical analysis of experimental data. Applications to the measurement of strain, force, pressure, temperature, and fluid flow. An emphasis is given to design of an experiment and error analysis using statistical data analysis.

MENG 3510 - Material Science

Credit(s): 3 Credits

A study of the material properties, atomic structure and bonding, mechanical failure theory, dislocation, phase diagrams, polymer structure, and ceramics.

Prerequisite(s): (CHEM 1070 or CHEM 1110); ESCI 3100

MENG 3910 - Co-Op with Industry

Credit(s): 0 Credits (Repeatable for credit)

A full-time supervised work experience with an agency, firm or organization that employs persons in this degree field. This course is used for the second experiential learning session.

MENG 3915 - Internship with Industry

Credit(s): 0-3 Credits (Repeatable for credit)

A work experience with an agency, firm or organization that employs persons in this degree field. This experience may be full time or part-time as required by the industry sponsor. This course is used for the first experiential learning session.

Restrictions:

Enrollment limited to students with a semester level of Junior or Senior.

MENG 3930 - Special Topics

Credit(s): 3 Credits (Repeatable for credit)

MENG 3980 - Independent Study

Credit(s): 1 or 3 Credits (Repeatable for credit)

MENG 4004 - Design I**Credit(s): 3 Credits**

Preliminary design of a mechanical system with emphasis on concurrent engineering, human factors, costs analysis, and material selection. The design project may be sponsored by industry or department. Also an emphasis is given to writing the design proposal and presenting it to a committee from the department.

Prerequisite(s): MENG 3010*

* Concurrent enrollment allowed.

MENG 4014 - Design II**Credit(s): 3 Credits**

Detailed design of a mechanical system, manufacturing the product if feasible, cost estimation, testing and demonstration of the product. A report on the final design is required and also the design should be presented to the faculty and peers from industry.

Prerequisite(s): MENG 4004**MENG 4300 - Heat Transfer****Credit(s): 3 Credits****Prerequisite(s):** (CSCI 1060 or CSCI 1300); (ESCI 2300 and ESCI 3200)**MENG 4450 - Principles of Mechatronics****Credit(s): 3 Credits**

Introduction to basic components: sensors, transducers, microprocessor-based systems and PLCs. Applications in motion control (AC/DC motors & stepper motors). A major project in electro-mechanical system design and development.

Prerequisite(s): ECE 2001**MENG 4910 - Co-Op with Industry****Credit(s): 0-3 Credits** (Repeatable for credit)

A full-time supervised work experience with an agency, firm or organization that employs persons in this degree field. This course is used for the third experiential learning session.

Prerequisite(s): MENG 3910**MENG 4915 - Internship with Industry****Credit(s): 0-3 Credits** (Repeatable for credit)

A work experience with an agency, firm or organization that employs persons in this degree field. This experience may be full time or part-time as required by the industry sponsor.

Prerequisite(s): MENG 3915**MENG 4930 - Special Topics: Mechanical Engineering****Credit(s): 3 Credits** (Repeatable for credit)**MENG 4980 - Independent Study****Credit(s): 0-3 Credits** (Repeatable for credit)

Credits to be arranged. Independent Study on a topic in Mechanical Engineering under the direction of a Faculty member.

MENG 5009 - Seminar**Credit(s): 0 Credits** (Repeatable for credit)

Presentations of current research by students, faculty, and guests. Registration required in the first semester. Seminar attendance expected in subsequent semesters.

MENG 5100 - Advanced Mechanics of Solids**Credit(s): 3 Credits**

Elasticity relations, linear elasticity assumptions, St. Venant's principle, transformation of stress, principal stresses in 3D, plane elasticity, Airy stress function, polynomial solutions, thermal stresses, relations in polar coordinates, point load solutions, stress concentration, axisymmetric problems, stresses in disks & cylinders, energy methods, Rayleigh Ritz, Buckling. Emphasis on advanced applications.

MENG 5110 - Fracture Mechanics and Plasticity**Credit(s): 3 Credits**

Advanced elasticity topics: plate theory, stress singularities at re-entrant corners, intro to fracture mechanics, mechanics of bonded interfaces, elastic contact mechanics; Plasticity topics: yield criteria in metal plasticity, deformation and incremental plasticity, elastic-plastic stress-strain relations, strain hardening, small-strain elastoplasticity (bending, torsion, buckling, disks and cylinders).

Prerequisite(s): (MENG 5150 or AENG 534); (MENG 5100 or AENG 538)**MENG 5120 - Structural Reliability****Credit(s): 3 Credits**

Fundamentals of reliability theory (factor of safety vs. reliability, modeling uncertainty, random variable distributions, design process uncertainty), Simulation methods and integration, computational issues for large scale problems, expansion techniques), second moment methods, reliability of structural systems (response surfaces, FFT approach, series and parallel systems, system reliability). Interdisciplinary engineering applications included.

Prerequisite(s): (MENG 5150 or AENG 534)**MENG 5150 - Finite Element Analysis I****Credit(s): 3 Credits**

Variational forms for 1D and 2D, Rayleigh Ritz, Galerkin, element matrices and assembly, formulation of axial/truss/beam/plane-frame structural elements, 2D field problem formulation, linear and triangular elements for heat transfer/irrotational flow, torsion of noncircular sections, elasticity, higher order and mapped elements, numerical integration. Lab applications and project included.

MENG 5160 - Finite Element Analysis II**Credit(s): 3 Credits**

Review of the finite element method and elasticity, variational methods, derivation of stiffness and mass matrices, isoperimetric element formulation, 3D beam elements, plates and shells, Guyan reduction, constraints, statically equivalent loading, eigenvalue problems, modal superposition, dynamic transient response, nonlinear finite element analysis (large deformation, plasticity, contact)

Prerequisite(s): (MENG 5150 or AENG 534)**MENG 5200 - Advanced Fluid Dynamics****Credit(s): 3 Credits**

Introduction to the physical concepts and mathematical analysis of fluid flow. Kinematics, stress, and thermodynamic properties of a fluid. Integral and differential equations for conservation of mass, momentum and energy. Applications in potential flow, viscous flow and compressible flow. Fluid flow measurements.

MENG 5220 - Experimental Methods in Fluid Dynamics**Credit(s): 3 Credits**

This lab-based course introduces students to the modern techniques used to investigate fluid dynamic problems, including pitot-static tubes, wake rakes, thermal anemometry, laser Doppler anemometry, particle image velocimetry, and pressure and temperature sensitive paints.

Prerequisite(s): MENG 5200**MENG 5230 - Viscous Flows****Credit(s): 3 Credits**

This course covers the development of the Navier-Stokes equations; laminar and turbulent boundary layers and associated similarity laws; introduction to stability; analytical and numerical solutions of engineering problems will be emphasized.

MENG 5240 - An Introduction to Turbulence**Credit(s): 3 Credits**

This course introduces the nature and origins of turbulence, transition mechanisms, turbulent transport of momentum and heat, dynamics of turbulence, wall-bounded and free shear flows, spectral dynamics, and statistical description of turbulence.

MENG 5530 - Composite Materials for Structure and Design**Credit(s): 3 Credits**

Fiber and resin systems, Composite material properties and characterization, lamina, Laminate, Micro-mechanics, Stress analysis of lamina and laminate, Design of laminate, Failure theories, and Manufacturing of laminate.

MENG 5700 - Multidisciplinary Optimization**Credit(s): 3 Credits**

Linear and nonlinear programming, unconstrained optimization, constrained optimization, structural optimization of large-scale systems with constraint approximations, analytical and numerical sensitivity analysis, design variable linking, optimization techniques for finite element problems, surrogate modeling techniques, shape and topology optimization. Interdisciplinary engineering applications emphasized.

Prerequisite(s): (MENG 5150 or AENG 534)**MENG 5810 - Technology Entrepreneurship****Credit(s): 3 Credits**

The course is intended as a general introduction to the models and applications of entrepreneurship. The course provides the basis for technology entrepreneurship mindset. The course will introduce the three major forms of entrepreneurship-independent (as in self-employment), corporate entrepreneurship and social venturing. In addition, the course will educate students about the three key elements of modern entrepreneurship: the recognition and creation of opportunities, the development of strategies to realize those opportunities, and the packaging of those opportunities for maximum impact in intended markets.

MENG 5902 - Numerical Methods Using Matlab and LabVIEW**Credit(s): 3 Credits**

This course will introduce students to the Matlab and LabVIEW programming packages while teaching how to use software and numerical methods to solve engineering problems. Problems of interest to Aerospace, Mechanical, Civil, Electrical, and Biomedical Engineering programs will be addressed.

MENG 5909 - Seminar**Credit(s): 0 Credits** (Repeatable for credit)

Presentations of current research by students, faculty, and guests. Registration required in the first semester. Seminar attendance expected in subsequent semesters.

MENG 5910 - Co-op with Industry**Credit(s): 1-6 Credits**

A full-time supervised work experience with an agency, firm or organization that employs persons in this degree field. This course is used for experiential learning session.

MENG 5915 - internship with Industry**Credit(s): 1-3 Credits**

A work experience with an agency, firm, organization that employs persons in this degree field. This experience may be full time or part time as required by the industry sponsor.

MENG 5930 - Special Topics**Credit(s): 1-3 Credits** (Repeatable for credit)

A one-time course on a particular topic, or a trial course that is expected to become a standard course with its own unique course number.

MENG 5964 - Master's Project**Credit(s): 1-3 Credits** (Repeatable for credit)

Theoretical/computational/experimental work that leads to a Project Report and of defense of the Project.

MENG 5974 - Research Topics**Credit(s): 1-3 Credits****MENG 5980 - Independent Study****Credit(s): 1 or 3 Credits** (Repeatable for credit)**MENG 5984 - Independent Study****Credit(s): 1-3 Credits** (Repeatable for credit)

A non-classroom course in which a student explores a topic that is related to the student's graduate work and career goals.

MENG 5994 - Master's Thesis Research**Credit(s): 0-6 Credits** (Repeatable for credit)

Research that leads to a Master's Thesis and final defense of the Thesis.

MENG 6910 - Co-op with Industry**Credit(s): 1-6 Credits**

A full-time supervised work experience with an agency, firm or organization that employs persons in this degree field.

MENG 6915 - Internship with Industry**Credit(s): 1-3 Credits**

A work experience with an agency, firm, organization that employs persons in this degree field. This experience may be full time or part time as required by the industry sponsor.

MENG 6930 - Special Topics**Credit(s): 3 Credits** (Repeatable for credit)**MENG 6974 - Research Topics****Credit(s): 1-3 Credits**

Theoretical or Computational or experimental work that is not part of the Dissertation.

MENG 6980 - Independent Study**Credit(s): 1 or 3 Credits** (Repeatable for credit)**MENG 6984 - Independent Study****Credit(s): 1-3 Credits** (Repeatable for credit)

A non-classroom course in which a student explores a topic that is related to the student's doctoral work and career goals.

MENG 6994 - Doctoral Dissertation Research**Credit(s): 0-6 Credits** (Repeatable for credit)

A non-classroom course in which a student explores a topic that is related to the student's doctoral work and career goals.