MECHANICAL ENGINEERING (MENG)

MENG 1300 INTRODUCTION TO CAD (3 credits)
Principles and accepted practices of geometric design. Computer generation of 2D and 3D models for mechanical systems. Introduction to engineering design practices such as specifications, dimensioning and tolerancing.

MENG 2000 ENGINEERING THERMODYNAMICS (3 credits)
First and Second Laws of Thermodynamics, properties of gases and vapors. Sources of energy and its conversion to work.
Prerequisite(s)/Corequisite(s): PHYS 2120; and MENG 2230 or EMEC 2230. Not open to non-degree graduate students.

MENG 2200 STATICS (3 credits)
Fundamental concepts, equilibrium of force systems, analysis of simple frames and trusses. Centroid and moments of inertia and friction.
Prerequisite(s)/Corequisite(s): MATH 1950

MENG 2230 ENGINEERING STATICS (3 credits)
The action of forces on engineering structures and machines. Force systems, static equilibrium of frames and machines. Friction, center of gravity, moment of inertia, vector algebra.
Prerequisite(s)/Corequisite(s): MATH 1960 with grade of C or better and PHYS 2110 with grade of C or better

MENG 2500 MECHANICS I (2 credits)
Force actions in static coplanar systems with applications to engineering structures and machines. Resultants, moments, couples, equivalent force systems, vector algebra. Static equilibrium conditions and equations. (For Electrical Engineering majors.)
Prerequisite(s)/Corequisite(s): PHYS 2110 and MATH 1970 coreq, not open to nondegree students

MENG 3000 THERMAL SYSTEMS AND DESIGN (3 credits)
Applications of control-volume analysis (mass, energy and momentum), both transient and steady; mixtures of gases and vapors; introduction to combustion; thermodynamic relations and establishment of data banks of thermal properties; applications of computer-aided engineering to processes and cycles; methodologies and case studies for thermal systems design; execution of small-scaled design projects.
Prerequisite(s)/Corequisite(s): MENG 2000, not open to nondegree students

MENG 3100 FLUID MECHANICS (3 credits)
Fluid statics, equations of continuity, momentum and energy; dimensional analysis and dynamic similitude. Applications to: flow meters; fluid pumps and turbines; viscous flow and lubrication; flow in closed conduits and open channels. Two-dimensional potential flow.
Prerequisite(s)/Corequisite(s): MENG 3730 or EMEC 3730; and MATH 2350; and MENG 2000 coreq. Not open to nondegree students

MENG 3110 FLUID MECHANICS LABORATORY (1 credit)
Fluid mechanics experiments and demonstrations. Conservation principles; determination of fluid properties, velocity, pressure, and flow measurements: pipe flow; open channel flow; and instrumentation.
Prerequisite(s)/Corequisite(s): MENG 3100 preq/coreq or CIVE 3100 pre/coreq, not open to nondegree students

MENG 3210 ENGINEERING STATISTICS AND DATA ANALYSIS (3 credits)
An application-oriented course for formulating and solving engineering statistical problems. Includes Descriptive statistics, probability distributions, variability, sampling, confidence intervals, tests of significance, basics of statistical process control, and design of experiments.
Prerequisite(s)/Corequisite(s): MATH 1970 (Math208 UNL)

MENG 3240 STRENGTH OF MATERIALS (3 credits)
Stress and strain analysis in elastic materials. Use of properties of materials in the analysis and design of welded and riveted connections, statically determinate and indeterminate flexure members, columns. Combined stresses, axial, eccentric and torsional loading. Observations of laboratory tests for axially loaded specimens. Introduction to shear and moment diagrams.
Prerequisite(s)/Corequisite(s): MENG 2200 or EMEC 2200

MENG 3250 MECHANICS OF ELASTIC BODIES (3 credits)
Concept of stress and strain considering axial, torsional and bending forces. Shear and moments. Introduction to combined stresses and column theory.
Prerequisite(s)/Corequisite(s): MENG 2230 or EMEC 2230; and MATH 1970

MENG 3300 MECHANICAL ENGINEERING ANALYSIS (3 credits)
Conceptual modeling of mechanical engineering systems. Analytical exploration of engineering behavior of conceptual models. Case studies drawn from mechanical engineering problems.
Prerequisite(s)/Corequisite(s): MATH 2350 and CSCI 1800 and MENG 3250 and MENG 3730 and MENG 2000. Not open to non-degree graduate students.

MENG 3420 KINEMATICS AND DYNAMICS OF MACHINERY (3 credits)
Prerequisite(s)/Corequisite(s): MENG 1300 and MENG 3730. Not open to non-degree graduate students.

MENG 3430 ELEMENTS OF MACHINE DESIGN (3 credits)
Design of machine elements under different conditions of loading. Design work includes a project of broader scope (done primarily out of class) requiring a breadth of knowledge. Failure theories for static and dynamic loading of bolts, springs, bearings, and shafts.
Prerequisite(s)/Corequisite(s): MENG 3250, ISMG or CONE 2060, MENG 3420, MATH 3600, and ENGL 3980. Coreq: STAT 3800 or MENG 3210. Not open to non-degree graduate students.

MENG 3500 INTRODUCTION TO DYNAMIC AND CONTROL OF ENGINEERING SYSTEMS (3 credits)
Unified treatment of the dynamics and control of engineering systems. Emphasis on physical aspects, formulation of mathematical models, application of various mathematical methods, and interpretation of results in terms of the synthesis and analysis of real systems. (Strong working knowledge of Matlab required.)
Prerequisite(s)/Corequisite(s): MENG 3730, and ELEC 2110 or ECEN 2110. Coreq: MATH 2050. Not open to non-degree graduate students.

MENG 3510 MECHANICS II (2 credits)
Applications of Newton's laws to engineering problems involving coplanar kinematics and kinetics of particles. Work, energy, impulse, and momentum. Conservative systems. Periodic motion. (For Electrical Engineering majors.)
Prerequisite(s)/Corequisite(s): MENG 2500 or EMEC 2500, not open to nondegree students

MENG 3600 ELEMENTS OF MATERIAL SCIENCE (4 credits)
(Lec 3, Lab 2) A four credit-hour lecture-lab class designed to acquaint students with the concepts of atomic, molecular and crystal structure of metals, alloys, polymers and ceramics. These fundamental concepts will be applied to design and optimization problems.
Prerequisite(s)/Corequisite(s): CHEM 1180 and EMEC 2230
MENG 3700 MANUFACTURING METHODS AND PROCESSES (3 credits)
An introduction to traditional and modern manufacturing processes and methods to include: foundry; forming processes; welding; metal removal theory and practices; modern manufacturing systems and automation; and economics of process selection.
Prerequisite(s)/Corequisite(s): MATL 3600 and MENG 3250. Not open to non-degree graduate students.

MENG 3730 ENGINEERING DYNAMICS (3 credits)
Prerequisite(s)/Corequisite(s): MENG 2230 or EMEC 2230; and MATH 1970

MENG 3800 MECHANICAL ENGINEERING MEASUREMENTS (3 credits)
Theory, statistics, applications and design of mechanical engineering experiments.
Prerequisite(s)/Corequisite(s): ELEC2310 and ENGL3980 and (STAT3800 coreq or ISMG3210 coreq) and MENG3500 and MENG3100, not open to nondegree students

MENG 3810 ELEMENTS OF COMPUTER-AIDED DESIGN (3 credits)
Principles and techniques currently used for the computer aided design (CAD). Applications of interactive graphics devices for drafting, design, and analysis. Modeling and analogy of engineering systems. Elementary finite element, Bode, and numerical analyses. CAD case studies and term project.
Prerequisite(s)/Corequisite(s): MATH2350 and (MENG1300 or CSC1620), not open to nondegree students

MENG 3990 UNDERGRADUATE RESEARCH AND THESIS (1-5 credits)
Engineering design or laboratory investigation that an undergraduate is qualified to undertake.
Prerequisite(s)/Corequisite(s): Not open to non-degree graduate students.

MENG 4010 ELEMENTS OF NUCLEAR ENGINEERING (3 credits)
Survey of nuclear engineering concepts and applications. Nuclear reactions, radioactivity, radiation interaction with matter, reactor physics, risk and dose assessment, applications in medicine, industry, agriculture, and research.
Prerequisite(s)/Corequisite(s): MATH 1970, PHYS 2120, and ENGR 3010 or ENGR 3100.

MENG 4020 TURBOMACHINERY (3 credits)
Thermodynamic analysis and design of axial and radial flow turbines, compressors, and pumps. Fundamentals of the operating characteristics and performance of turbomachines. Cavitation and blade element theory.
Prerequisite(s)/Corequisite(s): MENG3000 and (MENG3100 or CIVE310), not open to nondegree students

MENG 4030 INTERNAL COMBUSTION ENGINES (3 credits)
Basic cycle analysis and engine types, fundamental thermodynamics and operating characteristics of various engines are analyzed, combustion processes for spark and compression-ignition engines, fuels, testing procedures, and lubrication systems are evaluated. Emphasis on the thermodynamic evaluation of the performance and understanding the basic operation of various engine types.
Prerequisite(s)/Corequisite(s): MENG3000, not open to nondegree students

MENG 4040 THEORY OF COMBUSTION (3 credits)
Prerequisite(s)/Corequisite(s): MENG3000 and MENG4200, not open to nondegree students

MENG 4060 AIR CONDITIONING SYSTEM DESIGN (3 credits)
Application of thermodynamic principles to the design of air conditioning systems. A comprehensive design project will be an integral part of the course. (Cross-listed with MENG8066)
Prerequisite(s)/Corequisite(s): MENG3000

MENG 4070 POWER PLANT SYSTEM DESIGN (3 credits)
Application of the thermodynamic and fluid dynamic principles to the design of power plants. A comprehensive design project will be an integral part of the course. (Cross-listed with MENG8076)
Prerequisite(s)/Corequisite(s): MENG3000

MENG 4080 HEAT EXCHANGER DESIGN (3 credits)
Design methodology for various heat exchangers employed in mechanical engineering. Introduction to computer-aided design as applied to heat exchangers. Hands-on exercises in actual design tasks. (Cross-listed with MENG8086)
Prerequisite(s)/Corequisite(s): MENG3000

MENG 4130 AERODYNAMICS (3 credits)
Subsonic and supersonic air flow theory, dynamics of flight, performance parameters, rotoranlysis, and special topics.
Prerequisite(s)/Corequisite(s): MENG2000 and (MENG3100 or CIVE310), not open to nondegree students

MENG 4140 COMPRESSIBLE FLOW (3 credits)
Analysis of the flow of compressible fluids by means of the momentum equation, continuity equation, and the laws of thermodynamics and some application of thermodynamic laws to incompressible fluids.
Prerequisite(s)/Corequisite(s): MENG3000 and (MENG3100 or CIVE310), not open to nondegree students

MENG 4150 TWO-PHASE FLOW (3 credits)
Transportation phenomena of homogeneous and heterogeneous types of mixtures such as solid-liquid, liquid-liquid, and liquid-gas. Properties of components and mixtures. Flow induced vibrations and parameter distributions. Optimization and design problems in multiphase systems.
Prerequisite(s)/Corequisite(s): MENG3100 or CIVE310 and MENG3800 coreq, not open to nondegree students

MENG 4160 ENGINEERING ACCOUSTICS (3 credits)
Prerequisite(s)/Corequisite(s): MENG3100 and MATH2350, not open to nondegree students

MENG 4200 HEAT TRANSFER (3 credits)
Heat Transfer by conduction, convection, and radiation. Correlation of theory with experimental data and engineering design. (Cross-listed with MENG8206)
Prerequisite(s)/Corequisite(s): (CIVE310 or MENG3100), not open to nondegree students

MENG 4210 ELEMENTS OF NUCLEAR ENGINEERING (3 credits)
Survey of nuclear engineering concepts and applications. Nuclear reactions, radioactivity, radiation interaction with matter, reactor physics, risk and dose assessment, applications in medicine, industry, agriculture, and research. (Cross-listed with ENGR 4210).
Prerequisite(s)/Corequisite(s): MATH 1970, PHYS 2120, and ENGR 3010 or 3100

MENG 4220 INDUSTRIAL QUALITY CONTROL (3 credits)
Statistical process control and quality assurance techniques in manufacturing. Control charts, acceptance sampling, and analyses and design of quality control systems. (Cross-listed with MENG 8226)
Prerequisite(s)/Corequisite(s): MENG 3210 or STAT 3800
MENG 4240 LASER MATERIAL PROCESSING WITH COMPRESSIBLE FLOW PERSPECTIVE (3 credits)
Fundamentals of laser material processing. Laser material interactions from the compressible flow perspective. Analytical, semi-analytical, and numerical approaches.
Prerequisite(s)/Corequisite(s): Not open to nondegree students

MENG 4250 SOLAR ENERGY ENGINEERING (3 credits)
Conservation of solar energy into more useful forms with emphasis on environmental heating and cooling applications. Includes solar energy availability, solar collectors and design, solar systems and their simulation
Prerequisite(s)/Corequisite(s): MENG4200, not open to nondegree students

MENG 4260 HEAT TRANSFER AT NANOSCALES (3 credits)
Prerequisite(s)/Corequisite(s): MENG4200, not open to nondegree students

MENG 4310 COMPUTATIONAL HEAT TRANSFER AND FLUID FLOW (3 credits)
Prerequisite(s)/Corequisite(s): MENG3100 and MATH2050 and MENG4200 coreq, not open to nondegree students

MENG 4360 INTRODUCTION TO CONTINUUM BIOMECHANICS (3 credits)
Introduction to biomechanics. Basic anatomy, biomaterials, kinematics, dynamics, Viscoelasticity, bio-fluid mechanics, and bio-heat transfer.
Prerequisite(s)/Corequisite(s): MENG 3730 and MENG 3100 and MENG 4200. Not open to non-degree graduate students

MENG 4370 BIOMEDICAL DEVICE DESIGN (3 credits)
Design of devices intended for use in biomedical environments. Introduction to modeling of the bio-environmental, biomaterials, and material selection.
Overview of design methodologies and strategies used in biomedical device design from a material properties perspective. Introduction to federal regulation and other pertinent issues.
Prerequisite(s)/Corequisite(s): MENG 2230, MENG 3250, and MENG 3730 or equivalent.

MENG 4380 MECHANICS OF BIOMATERIALS (3 credits)
Theory, application, simulation, and design of biomaterials that apply mechanical principles for solving medical problems (case studies in artery, brain, bone, etc.). Tentative topics include Mechanical characterization of biomaterials; Bio-manufacturing a tissue; Function-structure relationship; Design and analysis of medical implants; Active response of biomaterials; growth and remodeling mechanism; Cellular behavior and measurements, etc. (Cross-listed with MENG 8386)
Prerequisite(s)/Corequisite(s): MENG 3430. Not open to non-degree graduate students.

MENG 4420 INTERMEDIATE KINEMATICS (3 credits)
Analytical can design. Geometry of constrained plane motion and application to the design of mechanisms. Analysis and synthesis of pin-joint linkage mechanisms.
Prerequisite(s)/Corequisite(s): MENG3420, not open to nondegree students

MENG 4440 INTERMEDIATE DYNAMICS OF MACHINERY (3 credits)
Fundamentals of vibration, vibration and impact in machines, balance of rotors, flexible rotor dynamics and instabilities, parametric vibration, advanced dynamics and design of cam mechanisms, and dynamics of flywheel.
Prerequisite(s)/Corequisite(s): MENG3420 and MENG3500, not open to nondegree students

MENG 4450 MECHANICAL ENGINEERING DESIGN CONCEPTS (3 credits)
Development of design concepts. Introduction to synthesis techniques and mathematical analysis methods. Application of these techniques to mechanical engineering design projects. (Cross-listed with MENG 8456)
Prerequisite(s)/Corequisite(s): MENG 2000 and MENG 3420 and MENG 3500 and (MENG 3100 or CIVE 310). Not open to non-degree graduate students.

MENG 4460 MECHANICAL ENGINEERING DESIGN I (3 credits)
Synthesis, design, and a written report on two projects, plus a proposal for the student’s final design project in MENG 4470. The two projects should span the general areas of mechanical engineering developing breadth, resourcefulness, creativity, and most importantly, the use of the design process. Guest lectures by practicing designers will be a part of the class when appropriate.
Prerequisite(s)/Corequisite(s): MENG300 and MENG3100 and MENG3430 and MENG3500, not open to nondegree students

MENG 4470 MECHANICAL ENGINEERING DESIGN II (2 credits)
Definition, scope, analysis, synthesis, and the design for the solution of a comprehensive engineering problem in any major area of mechanical engineering. (Cross-listed with MENG 8476)
Prerequisite(s)/Corequisite(s): MENG4460, not open to nondegree students

MENG 4480 ADVANCED MECHANICS OF MATERIALS (3 credits)
Stresses and strains at a point. Theories of failure. Thick-walled pressure vessels and spinning discs. Torsion of non-circular sections. Torsion of thin-walled sections, open, closed and multicelled. Bending of unsymmetrical sections. Cross shear and shear center. Curved beams. Introduction to elastic energy methods. (Cross-listed with EMEC8486)
Prerequisite(s)/Corequisite(s): MENG3250 or EMEC 3250; and MENG 3730 or EMEC 3730

MENG 4490 ADVANCED DYNAMICS (3 credits)
Particle dynamics using Newton’s laws, energy principles, momentum principles. Rigid body dynamics using Euler’s equations and Lagrange’s equations. Variable mass systems. Gyroscopic motion. (Cross-listed with EMEC 8496)
Prerequisite(s)/Corequisite(s): MENG 3730 or EMEC 3730; and MATH 2350. Not open to non-degree graduate students.

MENG 4500 MECHANICAL ENGINEERING CONTROL SYSTEMS DESIGN (3 credits)
Applications of control systems analysis and synthesis for mechanical engineering equipment. Control systems for pneumatic, hydraulic, kinematic, electromechanical, and thermal systems. (Cross-listed with MENG 8506)
Prerequisite(s)/Corequisite(s): MENG 3500. Not open to non-degree graduate students.

MENG 4510 INTRODUCTION TO FINITE ELEMENT ANALYSIS (3 credits)
Prerequisite(s)/Corequisite(s): Not open to non-degree graduate students.

MENG 4520 EXPERIMENTAL STRESS ANALYSIS I (3 credits)
Investigation of the basic theories and techniques associated with the analysis of stress using mechanical strain gages, electric strain gages, brittle lacquer, photoelasticity and membrane analogy. (Cross-listed with MENG 8526)
Prerequisite(s)/Corequisite(s): MENG 3250 or EMEC3250

MENG 4530 ROBOTICS: KINEMATICS & DESIGN (3 credits)
Robotics synthesize some aspects of human function by the use of mechanisms, sensors, actuators, and computers.
Prerequisite(s)/Corequisite(s): MENG3500, not open to nondegree students
MENG 4540 INTRODUCTION TO CONTINUUM MODELING (3 credits)
Basic concepts of continuum modeling. Development of models and solutions to various mechanical, thermal and electrical systems. Thermomechanical and electro-mechanical coupling effects. Differential equations, dimensional methods and similarity. (Cross-listed with MENG 8546)
Prerequisite(s)/Corequisite(s): MATH 2350; and MENG 3250 or EMEC 3250; and MENG 3730 or EMEC 3730. Not open to non-degree graduate students.

MENG 4550 VEHICLE DYNAMICS (3 credits)
Introduction to basic mechanics governing automotive vehicle dynamic acceleration, braking, ride, handling and stability. Analytical methods, including computer simulation, in vehicle dynamics. The different components and subsystems of a vehicle that influence vehicle dynamic performance. (Cross-listed with MENG 8556)
Prerequisite(s)/Corequisite(s): MENG3430, MENG 3500. Not open to non-degree graduate students.

MENG 4560 DYNAMICS OF INTERNAL COMBUSTION ENGINES (3 credits)
basics of design of the internal combustion engines. Design of various engine parts such as pistons, connecting rods, valve trains, crankshafts, and the vibration dampers. Dynamics of the engine. The vibration of the crankshaft assembly and the valve train. Balancing of the engines.
Prerequisite(s)/Corequisite(s): MENG3420 and MENG3430, not open to nondegree students

MENG 4580 DIGITAL CONTROL OF MECHANICAL SYSTEMS (3 credits)
Introduction to digital measurement and control of mechanical systems. Applications of analysis and synthesis of discrete time systems. (Cross-listed with MENG 8586)
Prerequisite(s)/Corequisite(s): MENG 4500. Not open to non-degree graduate students.

MENG 4700 THEORY AND PRACTICE OF MATERIALS PROCESSING (3 credits)
Theory, practice and application of conventional machining, forming, and non-traditional machining processes with emphasis on tool life, dynamics of machine tools and adaptive control. (Cross-listed with MENG 8706)
Prerequisite(s)/Corequisite(s): Not open to non-degree graduate students.

MENG 4740 MANUFACTURING SYSTEMS I (3 credits)
Principles of automated production lines; analysis of transfer lines; group technology; flexible manufacturing systems; and just-in-time; and optimization strategies for discrete parts manufacturing. (Cross-listed with MENG 8746)

MENG 4750 INTRODUCTION TO VIBRATIONS AND ACOUSTICS (3 credits)
Prerequisite(s)/Corequisite(s): MENG 3730 or EMEC 3730; and MATH 2350. Not open to nondegree students.

MENG 4760 MANUFACTURING INFORMATION SYSTEMS (3 credits)
An exploration of information systems and their impact in a manufacturing environment. Software, hardware, database systems, enterprise resource planning, networking, and the internet. (Cross-listed with MENG 8766)
Prerequisite(s)/Corequisite(s): Senior standing, and CIST 1400 or CSCI 1620 or CSCI 2240.

MENG 4800 NUMERICAL METHODS IN ENGINEERING (3 credits)
Numerical algorithms and their convergence properties in: solving nonlinear equations; direct and iterative schemes for linear systems of equations; eigenvalue problems; polynomial and spline interpolation; curve fitting; numerical integration and differentiation; initial and boundary value problems for Ordinary Differential Equations (ODE’s) and systems of ODE’s with applications to engineering; finite difference methods for partial differential equations (potential problems, heat-equation, wave-equation). (Cross-listed with MENG 8806)
Prerequisite(s)/Corequisite(s): MATH2350 or MATH8355

MENG 4830 ENGINEERING ANALYSIS WITH FINITE ELEMENTS (3 credits)
Analysis of engineering systems using finite elements; a critical and challenging task performed during the design process for many engineering systems. Four very distinct domains are studied: Structural stress analysis, heat transfer, fluid flow, and modal analysis. (Cross-listed with MENG 8836)
Prerequisite(s)/Corequisite(s): MENG 3100, MENG 3430, MENG 3500; Pre/Coreq: MENG4200. Not open to non-degree graduate students.

MENG 4870 THERMAL FLUIDS LABORATORY (2 credits)
Design, execution, and evaluation of physical experiments in the area of thermodynamics, fluid mechanics, and heat transfer.
Prerequisite(s)/Corequisite(s): MENG 3000, MENG 3800; MENG 4200 coreq.

MENG 4880 KINEMATICS AND MACHINE DESIGN LABORATORY (2 credits)
Design projects and physical experiments in the area of machine design and kinematics.
Prerequisite(s)/Corequisite(s): MENG 3420, MENG 3430; MENG 3800 coreq.

MENG 4910 SPECIAL TOPICS IN ENGINEERING MECHANICS (1-6 credits)
Treatment of special topics in engineering mechanics by experimental, computational and/or theoretical methods. Topics will vary from term to term. (Cross-listed with MENG 8916)

MENG 4980 LABORATORY AND ANALYTICAL INVESTIGATIONS (0-6 credits)
Investigation and written report of research into specific problem in any major area of mechanical engineering. (Cross-listed with MENG 8986)