MENG Mechanical Engineering

MENG 5090G Selected Topics in Mechanical Engineering
1-3 Credit Hours. 1-3 Lecture Hours. 1-6 Lab Hours.
This course provides for study of Mechanical Engineering course topics not generally offered by the program. Graduate students will be required to complete a case study or other individualized advanced activity that undergraduate students will not be required to complete.
Prerequisite(s): Graduate standing or Permission of Instructor.
Cross Listing(s): MENG 5090.

MENG 5135G Vibration and Preventive Maintenance
0,3 Credit Hours. 0,2 Lecture Hours. 0,2 Lab Hours.
Free and Forced Vibration of one and multi-degree of freedom systems will be covered. Applications of vibration analysis for preventive maintenance of mechanical systems will be introduced. Laboratories include basic vibration analysis and its applications. Graduate students will be expected to independently research an additional topic, write a summary report, and present their findings to the class.
Prerequisite(s): Completion of MENG 3531 or MENG 3531H and MENG 3130 or MENG 3130H and MATH 3230 or MATH 3230H or Permission of instructor.
Cross Listing(s): MENG 5135.

MENG 5136G Introduction to Finite Element Analysis
3 Credit Hours. 1 Lecture Hour. 4 Lab Hours.
This course will introduce students to the fundamentals of Finite Element Analysis. The students will develop a working knowledge of a commercial FEA software package and will model and analyze mechanical and thermal engineering systems using that software. The students will additionally develop an ability and competence in interpretation and analysis of FEA results. Graduate students will be required to complete a case study or other individualized advanced activity that undergraduate students will not be required to complete.
Prerequisite(s): A minimum grade of "C" in MENG 2139 and MENG 3135 and MENG 3233 and ENGR 2112 and ENGR 3235 or Permission of instructor.
Cross Listing(s): MENG 5136 and MENG 5136H.

MENG 5137G Mechanical System Design
3 Credit Hours. 0-3 Lecture Hours. 0-6 Lab Hours.
This is a senior design course requiring that students call upon all of their academic preparations in developing the solution of mechanical system problems. Graduate students will be expected to independently research an additional topic, write a summary report, and present their findings to the class.
Prerequisite(s): Completion of MENG 3130 and MENG 3135 and MENG 3233 and ENGR 3333 and MENG 3531 and a minimum grade of "C" in ENGR 2112 and ENGR 3235.
Cross Listing(s): MENG 5137, MENG 5137H.

MENG 5138G Composite Materials: Manufacturing, Analysis, and Design
0,3 Credit Hours. 0,2 Lecture Hours. 0,2 Lab Hours.
This course introduces basics of fiber reinforced, and laminated composites, anisotropic theory, stress analysis, design and testing of composite materials. Topics include an overview of structure and processing of composite materials, classification of anisotropy, anisotropic constitutive models, classical laminate theory, failure theories, and test methods. The knowledge will be applied to a design of simple composite structural elements. Graduate students will be required to complete a case study or other individualized advanced activity that undergraduate students will not be required to complete.
Prerequisite(s): A minimum grade of "C" in MENG 3135 or MFGE 3131 and MENG 3333 or MFGE 3531 or permission of instructor for graduate students.
Cross Listing(s): MENG 5138.

MENG 5233G Wind Energy
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
This course provides an in-depth introduction to modern wind turbine technology and the development of the wind power industry. Students will learn general characteristics of the wind resource and the atmospheric boundary layer. They will also learn how to analyze wind data, estimate wind resources and use statistical techniques to estimate wind turbine energy production. Aerodynamic characteristics of various turbine (HAWT and VAWT) models design, blade design, airfoils design, blade number effect and optimization techniques will be discussed theoretically and computationally for various applications. This course provides the general principles of wind turbine loads, mechanics, rotor dynamics, and methods for modeling turbine structural response. Electrical aspects of wind turbines, turbine control, turbine materials and components will also be studied, as well as, turbine design and testing, wind turbine siting, system design, and integration. Graduate students will be expected to independently research an additional topic, write a summary report, and present their findings to the class.
Prerequisite(s): Completion of MATH 2243 and MENG 3130 and MENG 3135 and MENG 3531 and a minimum grade of "C" in ENGR 2112, ENGR 2231, ENGR 3233 and ENGR 3235.
Cross Listing(s): MENG 5233.

MENG 5234G Heating, Ventilating, and Air Conditioning
0,3 Credit Hours. 0,2 Lecture Hours. 0,2 Lab Hours.
This is an introductory course in Heating, Ventilating, and Air Conditioning (HVAC) systems. In this course HVAC processes are analyzed and load calculations are performed in accordance with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) practices. Graduate students will be required to complete a case study or other individualized advanced activity that undergraduate students will not be required to complete.
Prerequisite(s): A minimum grade of "C" in ENGR 3431, ENGR 3235, MENG 3232 or Permission of Instructor.
Cross Listing(s): MENG 5234.

MENG 5235G Combustion
0,3 Credit Hours. 0,2 Lecture Hours. 0,2 Lab Hours.
This course is an introduction to the fundamentals of combustion processes, thermochemistry, chemical kinetics, simple chemical reactors, premixed and nonpremixed combustion, turbulent combustion and its practical applications including pollutant emissions. Graduate students will be required to complete a case study or other individualized advanced activity that undergraduate students will not be required to complete.
Prerequisite(s): ENGR 3235, ENGR 3431, MENG 3232 or Permission of Instructor.
Cross Listing(s): MENG 5235.
MENG 5237G Applied Combustion
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
This course is an introduction to the fundamentals of combustion processes, thermochemistry, chemical kinetics, simple chemical reactors, premixed and nonpremixed combustion, turbulent combustion and its practical applications, biofuel combustion, fuel surrogates, and pollutant emissions. Graduate students will be expected to independently research an additional topic, write a summary report, and present their findings to the class.
Prerequisite(s): A minimum grade of "C" in MENG 3233 or permission of instructor.
Cross Listing(s): MENG 5237.

MENG 5238G Engine Development and Performance
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
The design, development, operation, and environmental impact of internal combustion engines will be presented in this course with an engineering emphasis. Additionally, cycle evaluation and analysis of the energy systems, the efficiency and power generation, their benefits and costs will be determined. Graduate students will be expected to independently research an additional topic, write a summary report, and present their findings to the class.
Prerequisite(s): Completion of MENG 3521 and MENG 3233 or permission of instructor.
Cross Listing(s): MENG 5238.

MENG 5239G Biofuels Testing
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
The development of biofuels for engine operation and their environmental impact will be presented with an engineering emphasis. Additionally, life cycle evaluation, analysis of the energy systems and their efficiency with biofuels, together with benefits and costs will be determined. Graduate students will be required to complete a more advanced capstone design project that involves a class presentation and a more advanced technical analysis.
Prerequisite(s): MENG 3233 and a minimum grade of "C" in ENGR 3431 or permission of instructor.
Cross Listing(s): MENG 5239.

MENG 5331G Automation and Computer Integrated Manufacturing Systems
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
This course will cover the fundamental concepts in manufacturing, automation, and various topics in production and control systems. These include numerical control, industrial robots, computer integrated manufacturing systems, flexible manufacturing system, and process monitoring and control. Graduate students will be required to complete a capstone project that involves a class presentation and a more advanced technical analysis.
Prerequisite(s): A minimum grade of "C" in ENGR 1133 and ENGR 1721 or MFGE 2534 and MENG 3333 or MFGE 2533 or permission of instructor.
Cross Listing(s): MENG 5331.

MENG 5333G Robot Dynamics, Design and Analysis
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
An integrated treatment of robot kinematics, dynamics and control is introduced with an emphasis on analysis, design and programming of robots and their applications. Topics include planar and spatial kinematics, and motion planning; mechanism design for manipulators and mobile robots; forward and inverse kinematics, differential kinematics, manipulability, workspace design; planar and spatial multi-rigid-body-dynamics, dynamic models of robots; introduction to computer vision; robot programming; and robot control. Students will be engaged in laboratory activities to study kinematics, dynamics, programming and real-time control of robotic systems that include manipulators, mobile robots, and unmanned aerial vehicles (UAVs). Graduate students will be expected to independently research an additional topic, write a summary report, and present their findings to the class.
Prerequisite(s): Completion of MENG 3531 and MENG 3130 or permission of instructor.
Cross Listing(s): MENG 5333.

MENG 5431G Compressible Flow
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
This course introduces the basic equations and concepts of compressible flow. The generalized equations and solutions are developed and solved for: one-dimensional moving and normal shocks, oblique shocks, expansion fans, compressible flow with friction, and compressible flow with heat transfer. Software will be utilized to solve compressible flow problems. Graduate students will be expected to independently research an additional topic, write a summary report, and present their findings to the class.
Prerequisite(s): MENG 3233 or permission of instructor.
Cross Listing(s): MENG 5431.

MENG 5432G Applied Computational Fluid Dynamics
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
This course introduces the numerical techniques applied to the solution of fluid flow and heat transfer problems. The Finite Difference and Finite Volume methods are used to discretize and numerically solve the governing equations of heat transfer and fluid mechanics. A commercial computational fluid dynamics software is utilized for the analysis of heat transfer and fluid mechanics problems. Graduate students will be expected to independently research an additional topic, write a summary report, and present their findings to the class.
Prerequisite(s): MENG 3233 or permission of instructor.
Cross Listing(s): MENG 5432, MENG 5432H.

MENG 5536G Mechanical Controls
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
An understanding of the elements of classical control theory will be developed. Students will be introduced to the concepts of feedback and its properties; the concept of stability and stability margins; and the different tools that can be used to analyze these properties. Students will also develop a working knowledge of the basics of linear control techniques. Graduate students will be required to complete a case study or other individualized advanced activity that undergraduate students will not be required to complete.
Prerequisite(s): MENG 2139 and MENG 3130 and MENG 3531 or Permission of Instructor.
Cross Listing(s): MENG 5536 and MENG 5536H.

MENG 5891G Special Problems in Mechanical Engineering
1-3 Credit Hours. 1-3 Lecture Hours. 0-2 Lab Hours.
Individual and specialized study in the areas of mechanical engineering not otherwise covered in the students’ curriculum. Graduate students will be required to complete a case study or other individualized advanced activity that undergraduate students will not be required to complete.
Prerequisite(s): Graduate standing and identification of a problem or study area and permission of instructor.
Cross Listing(s): MENG 5891, MENG 5891H.
MENG 7137 Principles of Modeling and Simulation
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
This course provides an introduction to modeling and simulation techniques across diverse areas of engineering study for solutions of coupled physics, mechanics, chemistry, and even biological systems. The primary focus of the course will be on thermomechanical coupling, fluid and structure interaction, and electrical and thermal coupling analysis.
Prerequisite(s): MENG 5136 or permission of instructor.

MENG 7237 Intermediate Heat Transfer
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course will cover intermediate concepts related to conduction, convection and radiation heat transfer. Analytical solution methods for steady and transient conduction in one and two dimensions are developed and utilized. The continuity, momentum, and energy equations are derived and used in fundamental heat transfer applications. Radiation exchange between surfaces with and without participating media is presented and analyzed.
Prerequisite(s): MATH 5530 or permission of instructor.

MENG 7239 Intermediate Fluid Mechanics
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
In this course, the basic equations for multidimensional flow fields with ideal fluids and compressible fluids are derived. Advanced topics in fluid mechanics, including potential flow, boundary layer flow, compressible flow, and open channel flow are presented. Analytical techniques for solving problems are presented.
Prerequisite(s): MATH 5530 or permission of instructor.

MENG 7431 Mechanics of Deformable Solids
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course is an introduction to the fundamental mechanics of linear elasticity and elasto-plasticity, formulation and solution of simple static boundary value problems. Topics covered include constitutive equations for isotropic media, field equations for elastic solids, plane strain/plane stress and some classic analytical solutions, stress functions and potential methods.
Prerequisite(s): MENG 3331 and MATH 5530 or permission of instructor.

MENG 7432 Fracture Mechanics
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course is an introduction to linear elastic and elastic-plastic fracture, their fundamental concepts and applications. Topics include microstructural effects on fracture, toughening mechanisms, crack growth resistance, interface fracture mechanics, fatigue damage, fatigue crack growth models and mechanisms.
Prerequisite(s): MATH 5530 and a minimum grade of "C" in ENGR 3233 or permission of instructor.