

MECHANICAL ENGINEERING (MEEN)

MEEN 2112 Introduction to Programming 1 Credit

Department: College of Engineering

Development and implementation of algorithms in a procedure-oriented language, with emphasis on numerical methods for engineering problems.

Prerequisite(s): MATH 2414

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 2213 Introduction to Design 2 Credits

Department: College of Engineering

The course introduces students to the basics of engineering design and emphasizes the foundations of geometric modeling as applied to mechanical design through use of modern computer-aided design tools, such as SolidWorks; Introduces physical prototyping tools; geometric visualization concepts: projection, isometric, oblique, perspective; three-dimensional representations, surface, and solid modeling; dimensioning and tolerancing and 3D printing.

Prerequisite(s): PHYS 2425 and MATH 2415

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 2301 Statics 3 Credits

Department: College of Engineering

Statics is a course that covers the mechanics of particles and rigid bodies in static equilibrium in two- and three-dimensional space. This includes the calculations of translational and rotational forces using both scalar and vector computations in two- and three-dimensions. Force equilibrium concepts are extended to analyze trusses using both the method of joints and method of sections. A general introduction into elastic beam theory and internal force diagrams is presented. Finally, concepts involving center of mass, centroid of an area, and area moment of inertia are discussed.

Prerequisite(s): PHYS 2425 and MATH 2413

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 2302 Dynamics 3 Credits

Department: College of Engineering

This course will provide the students with a stepping-stone from physics to application of mechanics to design problems that will be encountered in advanced courses. Aspects of motion, forces, work, energy, impulse and momentum will be introduced to understand how they are applied to practical problems.

Prerequisite(s): MEEN 2301 or CVEN 2301

Prerequisite(s)/Corequisite(s): MATH 2415

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 2372 Mechanics of Solids 3 Credits

Department: College of Engineering

This course provides an introduction to the concepts of stress, deformation and strain in solid materials. Basic relationships between loads, stresses, and deflections of structural and machine elements such as rods, shafts and beams are developed. The load-carrying capacity of these elements under tension, compression, torsion, bending and shear forces are considered. It is essential for the prediction of structural failure in any industry application. This course is the pre-requisite to Dynamics, Machine Design and any further study in deformable mechanics.

Prerequisite(s): MEEN 2301

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 2374 Thermodynamics I 3 Credits

Department: College of Engineering

Properties of a pure substance and equations of state for ideal and real gases will be introduced with the concepts of work and heat during a thermal process. The first law of Thermodynamics will be presented with internal energy and enthalpy as applied to a system and a control of volume. The second law of thermodynamics as well as entropy transfer and generation during reversible and irreversible processes will be discussed, basic concepts of thermodynamic cycles (including Carnot cycle) and thermal efficiency will be covered.

Prerequisite(s): PHYS 2425 and MATH 2414

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 3210 Measurements Lab 2 Credits

Department: College of Engineering

Theory and application of measurements with various instruments are treated. Topics include technical report writing, statistics, and data acquisition. Experiments involving pressure, temperature, speed, power, torque, frequency and flow measurements are conducted, documented and reported.

Prerequisite(s): MEEN 3311 and MEEN 3380

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 3300 Design of Mechanism 3 Credits

Department: College of Engineering

This course helps students develop the ability to formulate and solve problems in the kinematics and dynamics of machinery; and to develop an understanding of the implications of computed results and to improve the design of machinery.

Prerequisite(s): MEEN 2302 and MEEN 2372

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 3310 Heat Transfer 3 Credits

Department: College of Engineering

Fundamental principles and theory of heat transfer by conduction, convection and radiation. Engineering applications and techniques, such as heat transfer from extended surfaces, and heat exchangers.

Prerequisite(s): MATH 3301 and ELEN 3310

Prerequisite(s)/Corequisite(s): MEEN 3311

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 3311 Fluid Mechanics 3 Credits**Department:** College of Engineering

This course introduces fluid flow concepts through the derivation of basic equations of mass, momentum, energy equations and their applications to engineering problems. Engineering aspects of flow measurements are covered and discussed as well as the use of Computational Fluid Mechanics (CFD) in engineering fluid mechanics.

Prerequisite(s): MEEN 2302 and MEEN 2374 and MEEN 2372 and MATH 3301**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 3320 Mechanical Design I 3 Credits****Department:** College of Engineering

The design of machine components considering the design process, loads, stress, deflection and stiffness, material properties; failure theories; designing for static strength and fatigue life. A written and oral presentation of the conceptual design of a machine to meet a specified societal need is required.

Prerequisite(s): CVEN 2372 or MEEN 2372**Corequisite(s):** MEEN 3350**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 3340 Engineering Analysis 3 Credits****Department:** College of Engineering

Physical and mathematical aspects of mechanical, hydraulic, pneumatic, thermal, and electrical systems are introduced. Analysis techniques for modeling the dynamic performance of lumped mass systems are presented and applied using a unified state-space representation. Both formal analytical and extensive computer methods are utilized for the determination of model response.

Prerequisite(s): MATH 3301**Prerequisite(s)/Corequisite(s):** MEEN 3311**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 3350 Computer-Aided Engineering 3 Credits****Department:** College of Engineering

An overview of simulation-based design, including 3-D parametric solids models and finite element analysis, and its applications in mechanical engineering. Course focuses on the modeling aspects of mechanical systems simulation in static stress and deflection analysis.

Prerequisite(s): MEEN 2302 and (CVEN 2372 or MEEN 2372)**Corequisite(s):** MEEN 3320**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 3380 Thermodynamics II 3 Credits****Department:** College of Engineering

Applications of thermodynamics principle and laws in power generation, propulsion and HVAC are introduced through concepts of vapor power cycles, air standard cycles, properties of gas mixtures, psychrometry, and thermodynamics of chemically reacting systems. Design aspects of engineering thermodynamics are introduced through assignments of open-ended problems and design projects. State-of-the-art software programs are introduced to solve the design problems and projects.

Prerequisite(s): MATH 3301 and MEEN 2374**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 4110 Seminar 1 Credit****Department:** College of Engineering

Instruction in effective public speaking. Oral and written presentation and discussion of selected topics including those from current literature of fields related to mechanical engineering. Professional activities are encouraged.

Restriction(s):Students with a class of Freshman, Junior or Sophomore may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 4301 Special Topics 3 Credits****Department:** College of Engineering

An investigation into specialized areas of engineering under the guidance of a faculty member. This course may be repeated for credit when topics of investigation differ.

May be Repeated for a maximum of 9 hours

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS, Satisfactory/Unsatisfactory**MEEN 4310 Integrated System Design 3 Credits****Department:** College of Engineering

The first of a sequence of two senior design courses. Students work in teams on complex engineering projects in which they are exposed to the design process from concept to analysis to prototyping and reporting.

Prerequisite(s): MEEN 3210 and MEEN 3300 and MEEN 3310 and MEEN 3311 and MEEN 3320 and MEEN 3340 and MEEN 3350 and MEEN 3380 and INEN 3322**Restriction(s):**

Enrollment limited to students with a class of Post Baccalaureate, Post Masters Student or Senior.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 4313 Thermal Systems Design 3 Credits****Department:** College of Engineering

This course covers analysis, modeling and design of thermal systems involving applications of thermodynamics, fluid mechanics, heat transfer and engineering economics. The student will complete an engineering project involving design of a thermal or energy system considering realistic engineering constraints, component selection, system modeling and simulation and life-cycle economic analysis.

Prerequisite(s): MEEN 3310 and MEEN 3380 and MEEN 3311 and INEN 2373**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 4316 Engineering Design Project 3 Credits****Department:** College of Engineering

The second of a sequence of two senior design courses. Students work in teams on complex engineering projects in which they are exposed to the design process from concept to analysis to prototyping and reporting.

Prerequisite(s): MEEN 4310**Restriction(s):**

Enrollment limited to students with a class of Doctoral Candidate, Graduate, Post Baccalaureate, Post Masters Student, Post Bacc UG Degree Seeking or Senior.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 4317 Dynamic Systems Analysis 3 Credits**Department:** College of Engineering

A continuation of MEEN 3340 with emphasis on simulation methods and computer techniques in solving engineering problems.

Prerequisite(s): MEEN 3340 and MEEN 3350**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 4319 Materials Science 3 Credits****Department:** College of Engineering

This course provides a basic knowledge of materials science, the structure and properties of different materials, and their practical uses along with possible failures, which are quite essential for a mechanical engineer to learn. This course also has laboratory sessions teaching different techniques and equipment that help in studying or analyzing the materials structures and properties.

Prerequisite(s): MEEN 2372 and PHYS 2425 and PHYS 2426 and (CHEM 1411 or CHEM 1311)**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 4321 Applied Numerical Analysis 3 Credits****Department:** College of Engineering

The course covers the advanced topics in numerical methods and their applications in different engineering problems which include experimental data analysis and statistical methods, optimization methods and numerical methods in solving differential equations. Student will use the commercial software of Matlab and Excel in this course. Offered: Other

Restriction(s):Students with a class of Freshman, Junior or Sophomore may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 4323 Mechanical Design II 3 Credits****Department:** College of Engineering

A continuation of the design of machine components including the design of threaded fasteners and power screws, welded joints, mechanical springs, lubrication and sliding bearings, rolling-element bearings, spur gears, shafts, clutches and brakes, and miscellaneous power transmission components. Completion of the conceptual design begun in MEEN 3320 to include the addition of a power source, greater design detail in the elements, economic aspects of the design, and other matters as appropriate. Both a report and a presentation are required. Team formation and the use of various engineering software packages are encouraged.

Prerequisite(s): MEEN 3320**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 4324 Engineering Fracture Mechanics 3 Credits****Department:** College of Engineering

This course introduces the fundamental principals of linear elastic fracture mechanics in mechanical design and extends students' knowledge in mechanical component design with consideration of cracks. It also introduces stress intensity factors and energy release rates and calculation of stress intensity factors in various configurations.

Prerequisite(s): MEEN 2372**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 4325 Undergraduate Research 3 Credits****Department:** College of Engineering

The purpose of the class is to provide undergraduate students a unique opportunity to experience hands-on interdisciplinary research in the field of mechanical engineering. Selected students are generally in the senior year of their study with GPA > 3.2 and have sufficient basic knowledge to conduct research.

Prerequisite(s): MEEN 3310 and MATH 3301 and MEEN 3320**Restriction(s):**Students with a class of Freshman or Sophomore may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 4326 Control of Mechanical Systems 3 Credits****Department:** College of Engineering

Mathematical modeling of various systems, transient and steady-state response, frequency response analysis, root-locus, stability, control system design, steady-states representations, controllability and observability and design of system in state space.

Prerequisite(s): MEEN 2302 and MATH 3301 and ELEN 3310**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 4350 Turbomachinery 3 Credits****Department:** College of Engineering

Flow problems encountered in the design of water, gas and steam turbines, centrifugal and axial-flow pumps and compressors, aerothermodynamic design of gas turbines.

Prerequisite(s): MEEN 3311 and MEEN 3380**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 4360 Intro to CFD 3 Credits****Department:** College of Engineering

This is an introductory course of Computational Fluid Dynamics (CFD). It will cover the basic concepts underlying the computational fluid dynamics including derivation of governing equations, discretization, grid generation, applications or numerical methods, error reduction, and solution testing, and interpretation of numerical results. Commercial CFD software packages will be used to solve practical engineering fluid dynamics problems.

Prerequisite(s): MEEN 3310 and MEEN 3311 and MEEN 3340**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 4362 Energy Engineering 3 Credits****Department:** College of Engineering

Different types of energy resources and their uses, different types of energy conversion technology such as fuel cells, thermoelectric, and solar energy conversion, and energy conservation technologies such as pinch technology and cogeneration, current and future challenges of energy generation and conservation, environmental issues such as air pollution, smog and greenhouse effects, and NOx emissions.

Prerequisite(s): MEEN 3310 and MEEN 3311 and MEEN 3380**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 4366 Manufacturing Analysis 3 Credits

Department: College of Engineering

Theoretical considerations in casting, bulk deformation, sheetmetal forming, polymers parts machining and welding process will be taught in this manufacturing course.

Prerequisite(s): INEN 3322

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 4368 Gas Turbn heat Trans/Cool Tech 3 Credits

Department: College of Engineering

The important and fundamental consideration of gas turbines heat transfer and cooling are introduced. Different aspects of internal cooling and film cooling technologies are discussed. State-of-the-art experimental design and numerical modeling related to gas turbines heat transfer and cooling are presented.

Prerequisite(s): MEEN 3310 and MEEN 3311

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 4369 Energy Conservation/Management 3 Credits

Department: College of Engineering

Students will learn fundamental of energy conservation and management, energy audit procedures, energy conservation analysis and technologies to improve energy efficiency.

Prerequisite(s): MEEN 3310 and MEEN 3380

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 5101 Special Topics 1 Credit

Department: College of Engineering

An investigation into specialized study in advanced areas of engineering under guidance of a faculty member. This course may be repeated for credit when topics of investigation differ.

Restriction(s):

Undergraduate level students may **not** enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 5201 Special Topics 2 Credits

Department: College of Engineering

An investigation into specialized study in advanced areas of engineering under guidance of a faculty member. This course may be repeated for credit when topics of investigation differ.

Restriction(s):

Undergraduate level students may **not** enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 5301 Special Topics 3 Credits

Department: College of Engineering

An investigation into specialized study in advanced areas of engineering under guidance of a faculty member. This course may be repeated for credit when topics of investigation differ.

May be Repeated for a maximum of 9 hours

Restriction(s):

Undergraduate level students may **not** enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS, Satisfactory/Unsatisfactory

MEEN 5304 Advanced Engineering Analysis 3 Credits

Department: College of Engineering

The course covers selected topics of advanced engineering mathematics and their applications to engineering. The topics include analytical and numerical solutions of ordinary and partial differential equations, vector differential calculus and integral theorems, probability and statistics, and optimization.

Restriction(s):

Undergraduate level students may **not** enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 5310 Energy Conservation/Management 3 Credits

Department: College of Engineering

Students will learn fundamentals of energy conservation and management, energy audit procedures, energy conservation analysis, and technologies to improve energy efficiency.

Restriction(s):

Undergraduate level students may **not** enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 5312 Optimization Ther Sys 3 Credits

Department: College of Engineering

The course deals with the design and optimization of thermal systems. The course covers selection of typical components of thermal systems such as heat exchangers, pumps and fans, economic analysis of thermal systems, system simulations, and different methods of optimization, and their applications in the optimization of thermal systems culminated in a group optimization project. A formal oral presentation of a written technical report is required.

Prerequisite(s): MEEN 3310 and MEEN 3340 and MEEN 3380

Restriction(s):

Undergraduate level students may **not** enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 5317 Adv Fracture Mechs in Mech DSN 3 Credits

Department: College of Engineering

Theory of fracture mechanics with engineering applications advanced stress analysis using finite element (FEA) analysis with emphasis on the cracked structures. Offered: Other

Restriction(s):

Undergraduate level students may **not** enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 5319 Modeling & Simulation 3 Credits**Department:** College of Engineering

Students will learn advanced FEA techniques and the applications, advanced knowledge in solid mechanics and its applications, and advanced skills with ANSYS software.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5321 App Numerical Analysis 3 Credits****Department:** College of Engineering

Introduction to numerical techniques and their applications in different engineering problems, experimental data analysis and statistical methods, optimization methods, and numerical methods in solving differential equations.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5323 Advanced Heat Transfer and Applications 3 Credits****Department:** College of Engineering

The course covers advanced theory of heat transfer by conduction, convection and radiation - emphasizing 2- and 3-dimensional analysis in industrial applications using analytical equations and numerical simulations.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5324 Component/System Design with Simulation 3 Credits****Department:** College of Engineering

The purpose of this class is to apply finite element analysis or other simulation techniques to solve a design problem in the field of heat transfer, stress analysis, vibration or fluid mechanics, or coupled multi-physics problems. Students are encouraged to use the finite element analysis or other simulation software, or write their own codes to solve the problems.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5325 Finite Element Analysis with ANSYS 3 Credits****Department:** College of Engineering

This class introduces the students to effective finite element problem solving by demonstrating the use of the comprehensive ANSYS Finite Element Method Software in a series of step-by-step tutorials. Both ANSYS Mechanical and ANSYS Workbench will be covered. ANSYS APDL will be introduced.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5326 Control of Mech Systems 3 Credits****Department:** College of Engineering

Mathematical modeling of various systems, transient and steady-state response, frequency response analysis, root-locus, stability, control system design, steady-states representations, controllability and observability, and design of system in state space.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5329 Advanced Solid Mechanics 3 Credits****Department:** College of Engineering

Deformation and stress analysis, mathematical preliminaries (tensor basics, variational method), strain-displacement relations in general, theory of linear elasticity and energy methods. Fundamental principles of fracture mechanics in mechanical design and engineering applications. May be Repeated for a maximum of 6 hours

Prerequisite(s): CVEN 2372**Prerequisite(s)/Corequisite(s):** MEEN 5304**Restriction(s):**Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5330 Two Phase Flow and Heat Transfer 3 Credits****Department:** College of Engineering

Learn current status of two-phase flow and heat transfer. Introduction of the current state-of-the-art applications in liquid-vapor phase change heat transfer is discussed.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 5331 CFD with OpenFOAM 3 Credits**Department:** College of Engineering

This course covers selected topics of Computational Fluid Dynamics (CFD) studies including a brief introduction of CFD and then systematic teaching on the fundamental structures of OpenFOAM with its programming features. One- and two-phase flows will be solved.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5333 Tribology 3 Credits****Department:** College of Engineering

The course covers essential topics in tribology, a branch of mechanical/material engineering. By definition, tribology is the science and engineering of interacting surfaces under relative motion. It is the study and application of the friction, lubrication and wear principles in engineering and design. It covers the contact of surfaces, mechanics of friction, surface failures/wear, boundary lubrication, fluid properties, thin film (elastohydrodynamic) lubrication, thick film (hydrodynamic) lubrication, and an introduction to emerging tribology (micro/nanotribology and biotribology). Tribology is an interdisciplinary area, and most importantly still has many unknowns.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5335 Mechanical Vibrations 3 Credits****Department:** College of Engineering

Topics in mechanical vibrations including an introduction to the theory of vibrations, mechanical vibration analysis methods using simulation based design, mechanical vibration measurement and monitoring, interpretation of vibration measurements data and other mechanical vibration topics as appropriate.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5341 Modeling of Supercritical Fluids 3 Credits****Department:** College of Engineering

This course covers analysis and design of supercritical fluids (SCF) systems used in industrial applications. The students will learn the mathematical models of SCF, analyze SCF problems from several industrial examples and design specific SCF processing using numerical computations.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5342 Mechanism Design and Analysis 3 Credits****Department:** College of Engineering

This course covers the fundamental knowledge in mechanism design and analysis. The course utilizes analytical, graphical and computer-aided methods to solve practical problems and to perform force analysis in kinematics and dynamics of machinery. Students are expected to design mechanisms for assignments and projects.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5350 Turbomachinery 3 Credits****Department:** College of Engineering

Flow problems encountered in the design of water, gas and steam turbines, centrifugal and axial-flow pumps and compressors, aerothermodynamic design of gas turbines.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS, Satisfactory/Unsatisfactory**MEEN 5362 Energy Engineering 3 Credits****Department:** College of Engineering

Different types of energy resources and their uses, different types of energy conversion technology, such as fuel cells, thermoelectric, and solar energy conversion, and energy conservation technologies such as pinch technology and cogeneration, current and future challenges of energy generation and conservation, environmental issues such as air pollution, smog and greenhouse effects, and NO_x emissions.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5365 Adv Materials Science 3 Credits****Department:** College of Engineering

Introduction to mechanical properties of engineering materials. Intro to kinetics of structural transformations and fundamentals aspects of structural transformations.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 5366 Manufacturing Analysis 3 Credits**Department:** College of Engineering

Students will be introduced to manufacturing as a system, different properties of castings and structure, melting and pouring principals, analysis of sheet forming and melt processing: design with plastics and composites metal cutting processes, machinability and cutting tools introduced. Students learn mechanical joining and solid state bonding and analysis of liquid state welding.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5368 Combustion Theory 3 Credits****Department:** College of Engineering

Fundamental principals of combustion theory and their applications in different engineering problems such as furnaces, automotive engines, gas turbines, and rockets. Topics covered include thermochemistry, fuels, chemical kinetics, conservation equations for reacting flows, premixed and diffusion flames, droplet burning, and pollutant emissions, introduction to numerical modeling of combustion and combustion measurement techniques.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5370 Gas Turbn Heat Trans/Cool Tech 3 Credits****Department:** College of Engineering

The importance and fundamental consideration of gas turbines heat transfer and cooling are introduced. Different aspects of internal cooling and film cooling technologies are discussed. State-of-the-art experimental design and numerical modeling related to gas turbines heat transfer and cooling are presented.

Prerequisite(s): MEEN 3310 and MEEN 3311**Restriction(s):**Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 5389 CAD 3 Credits****Department:** College of Engineering

Introduction to ProEngineer. The analysis and the utilization of state of the art computer hardware and software to solve the problems associated with the utilization of computers in both graphics and engineering design problems.

Restriction(s):Undergraduate level students may **not** enroll.

Enrollment limited to students in the College of Engineering college.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 6110 Professional Seminar 1 Credit****Department:** College of Engineering

Advanced topics suitable for research along with research procedures will be discussed. Field study organization and content together with doctoral research problems and progress will be represented. Topics will vary each semester and course may be repeated for credit. Registration and completion for three semesters is required of all doctoral candidates.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 6310 Design Projects 3 Credits****Department:** College of Engineering

May be repeated for credit when the subject matter varies.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 6312 Advanced Topics in Thermal Fluids 3 Credits****Department:** College of Engineering

This course covers advanced topics on thermal fluid systems selected by the instructor, e.g. supercritical fluids, multiphase flows, fluid structure interactions, tribology, nanofluids, electric cooling, etc. Students will learn the fundamental theories, build mathematical models and design thermal fluid systems on the selected topics.

Restriction(s):Graduate or Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 6315 Advanced Engineering Mathematics 3 Credits****Department:** College of Engineering

This course covers mathematical and computational applications into selected engineering problems. The course utilizes ordinary and partial differential equations, vector differential calculus and integral theorems, probability and statistics, and optimization to model, evaluate and solve practical engineering problems.

Restriction(s):Graduate or Undergraduate level students may **not** enroll.**Grade Mode(s):** Standard Letter, Registrar do not use FN, Registrar do not use FS**MEEN 6320 Justification Engineering Proj 3 Credits****Department:** College of Engineering

The preparation of proposals for advanced engineering work. The student will be given individual assistance in preparing a proposal for his field of study.

Restriction(s):Undergraduate level students may **not** enroll.**Grade Mode(s):** Satisfactory/Unsatisfactory, Registrar do not use FN, Registrar do not use FS

MEEN 6332 Advanced Topics in Computational Fluids 3 Credits

Department: College of Engineering

This course covers selected topics of Computational Fluid Dynamics (CFD) from programming of CFD to advanced studies on featured software, e.g. Fluent, OpenFOAM etc. Topics will be selected and designed by each individual instructor.

Restriction(s):

Graduate or Undergraduate level students may **not** enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 6385 Advanced Stress Analysis 3 Credits

Department: College of Engineering

Deformation and Stress analysis, mathematical preliminaries (tensor basics, variational method), strain-displacement relations in general, theory of linear elasticity and energy methods.

Restriction(s):

Undergraduate level students may **not** enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 6387 Fracture & Fatigue of Solids 3 Credits

Department: College of Engineering

Stress analysis of cracked elastic and inelastic solids; fundamental principals of fracture mechanics in mechanical design and engineering applications; failure criteria for brittle and ductile materials; low-cycle and high-cycle fatigue and fatigue mechanisms.

Restriction(s):

Undergraduate level students may **not** enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

MEEN 6388 Advanced Finite Element Method 3 Credits

Department: College of Engineering

Finite element method in the study of the static response of complex structures and of continua; applications to field problems, energy & variation methods emphasized and ANSYS software introduced.

Restriction(s):

Undergraduate level students may **not** enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS