



PMU

جامعة الأمير محمد بن فهد
PRINCE MOHAMMAD BIN FAHD UNIVERSITY

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Course Description for COE courses

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Assessment – ASSE

[Civil, Electrical and Mechanical Engineering](#)

ASSE 4311: Learning Outcome Assessment III (3,0) This Capstone course in the PMU Civil, Electrical, and Mechanical Engineering programs requires students to complete a design project from project identification through problem statement, conceptual design, project analysis, final design, report preparation, and a final oral presentation. Students work in groups of three (ideally, one student from each major) and apply the knowledge they have acquired to demonstrate their mastery of the discipline through a well-executed project. **Prerequisite:** Academic standing as a second semester senior

Civil Engineering – CVEN

CVEN 3322: Materials in Civil Engineering (2,1) This course provides students with basic knowledge of the properties and behavior of materials commonly used in civil engineering structural systems.

Various materials, such as wood, aggregates, cement concrete, asphalt concrete, and steel are studied in this course. Students find the knowledge they learned from this course useful to various design, analysis, construction, and maintenance projects in their current or future civil engineering practices. **Prerequisites:** MEEN 2211: Materials Engineering, MEEN 2313: Mechanics of Solids

CVEN 3311: Structural Analysis (3,0) This course provides students with the concepts and methods in the design and analysis of civil engineering structure systems. The course familiarizes students with theory and techniques for the analysis of framed structures, trusses, girders, and beams. Students learn to solve statically determinate and indeterminate structure systems using classical methods, influence lines, and stiffness matrices. Students learn to determine deflections and deformations of a structural system under external static and dynamic loads. The course focuses on problem solving to help students acquire knowledge in the theory and analysis of structure and its behavior.

Prerequisites: GEEN 2311: Statics and Dynamics of Rigid Bodies I, Concurrent Registration of MEEN 2313: Mechanics of Solids

CVEN 3312: Reinforced Concrete Design (3,0) This course develops students' ability in the analysis, design, and application of reinforced concrete in civil engineering structures. The course familiarizes students with the strength and deformation of reinforced concrete and design of beams, columns, slabs, footings, and retaining walls using current design specifications. While the U.S. Building Code Requirements for Structural Concrete (ACI 318-02) are used in the discussion and practice of this course, the current U.S. ACI-equivalent specifications for the Kingdom of Saudi Arabia are preferred.

Prerequisites: CVEN 3311: Structural Analysis, MEEN 2313: Mechanics of Solids

CVEN 3321: Engineering Geology (3,0) This course provides students with an understanding of the principles of physical geology and their practical applications to civil engineering. **Prerequisites:** CHEM 1421: Chemistry for Engineers I, PHYS 1421: Physics for Engineers I, GEEN 2311: Statics and Dynamics of Rigid Bodies I

CVEN 3331: Environmental Engineering Fundamentals (3,0) This course introduces students to the fundamental principles of environmental engineering and environmental ethics that lead to sustainability for humans and the ecological systems that support us. **Prerequisites:** CHEM 1421: Chemistry for Engineers I, MATH 1422: Calculus I, GEEN 3311: Introduction to Fluid Mechanics

CVEN 3341: Engineering Measurements (2,1) This course introduces students to the theories and practices of various types of survey measurements commonly used in civil engineering. The course covers classic and modern surveying topics including error propagation, linear measurements, angle measurements, area determination, differential leveling, topographic mapping, and geographic information system. **Prerequisites:** GEEN 1211: Introduction to Engineering, PHYS 1421: Physics for Engineers I, PHYS 1422: Physics for Engineers II.

CVEN 4313: Design of Steel Structures (3,0) This course introduces students to the behavior and design of elements in steel structures using current design specifications. The AISC LRFD Code is the choice of design specifications and is used in this course. Students apply their knowledge from

statics, mechanics of solids, and structural analysis to gain further understanding in the relationship between analysis and design of steel structures. Students learn the design of steel structural elements including tension members, compression members, beams, members under combined loads, beam-column members, and connections between these elements. The AISC LRFD Code is the choice of design specifications and is used in this course. **Prerequisites:** CVEN 3311: Structural Analysis, MEEN 2313: Mechanics of Solids

CVEN 4314: Construction Management (3,0) This course provides students with fundamental principles and concepts of construction project management. Students learn the principles and skills of cost estimation, project planning, activity scheduling, staffing, cost and schedule control, project progress measurement, and quality control. Students also learn how to implement a construction project through the use of computer software. **Prerequisites:** GEEN 3211: Engineering Economy, MATH 1422 Calculus I.

CVEN 4324: Foundation Analysis and Design (3,0) This course provides students with advanced knowledge in the design principles and methods for foundations and earth retaining structures. Students develop a good understanding of the soil and rock mechanics that are critical in the design of foundation, the theories and practices in various types of foundations, the design of spread footings, rafts, and pile foundations according to modern professional practice. **Prerequisites:** CVEN 3322: Materials in Civil Engineering, CVEN 4423: Introduction to Geotechnical Engineering

CVEN 4333: Water and Wastewater Treatment (3,0) This course provides students with a fundamental understanding of the principles of water supply and wastewater engineering and their applications to design and operation of municipal and industrial water treatment systems. Students develop concepts of water quality standards, physical, chemical, and biological treatment processes of water and wastewater, transportation, storage and distribution of water systems, wastewater collection, and wastewater treatment. **Prerequisites:** CVEN 3331: Environmental Engineering Fundamentals, CVEN 4432: Hydraulic Engineering

CVEN 4334: Air Pollution and Control (3,0) This course provides an overview of air pollution. It covers topics such as air pollution meteorology, sources of pollution, pollutant fate and transport, effects of air pollution on human health and the environment, ambient air monitoring, pollution abatement, design and control of gaseous and particulate matter pollutants, and global climate change. **Prerequisites:** CVEN 3331: Environmental Engineering Fundamentals, GEEN 3311: Introduction to Fluid Mechanics.

CVEN 4342: Transportation Engineering (3,0) This course introduces the fundamental principles of transportation engineering, design, and planning. Students develop the skills to model, plan, and manage different components of transportation systems. These components include transportation economics, individual vehicle motion, geometric design of highway, vehicle and human characteristics, traffic flow, highway capacity, highway intersection control and design, and urban transportation. **Prerequisite:** CVEN 3341: Engineering Measurements

CVEN 4343: Engineering Probability and Statistics (2,1) This course introduces the fundamental concepts of probability theory and random processes, engineering data analysis and descriptive statistics, and classical statistical inference. Students learn statistical computing with the Excel software packages. **Prerequisite:** MATH 1324: Calculus III

CVEN 4423: Introduction to Geotechnical Engineering (3,1) This course provides an understanding of the principles and practices of geotechnical engineering. The knowledge is important in many sub-disciplinary areas of civil engineering including environmental, structural, transportation, surveying and foundation engineering. Students develop knowledge of the physical and chemical properties of soil, stresses and strains in saturated soils, and testing procedures to determine mechanical and index properties of soils. Students develop skills to perform basic geotechnical analysis and to address geotechnical problems typically faced by civil engineers. **Prerequisites:** CVEN 3322: Materials in Civil Engineering, GEEN 3311: Introduction to Fluid Mechanics

CVEN 4432: Hydraulic Engineering (3,1) This course introduces students to the essential principles of hydrology and hydraulic engineering. Students acquire fundamental knowledge in hydraulic engineering and develop a depth of understanding in hydrology, groundwater, flows in pipes and piping systems, and open channel hydraulics, hydraulic structures and machinery, and flood damage reduction. **Prerequisite:** GEEN 3311: Introduction to Fluid Mechanics

Electrical Engineering – EEEN

EEEN 2111: Circuits I Lab - Also listed as COEN 2111: Circuits I Lab (0,1) This course covers experimental aspects of the topics covered in GEEN 2314: Circuits I. Topics include basic breadboarding techniques and circuit construction; use of multi-meters, oscilloscopes, power supplies, and function generators; DC and AC voltage and current measurement techniques; troubleshooting techniques; and comparison of experimental and simulated circuits. **Prerequisites:** MATH 1324: Calculus III, PHYS 1422: Physics for Engineers II. Completion of or concurrent registration for: MATH 2332: Differential Equations, GEEN 2314: Circuits I

EEEN 3312: Circuits II - Also listed as COEN 3312: Circuits II (2,1) This course is a continuation of GEEN 2314: Circuits I. Topics include a review of DC and AC circuit analysis techniques; complex numbers

and phasors; use of phasors in the analysis of AC circuits; AC power concepts; polyphase circuits; magnetically coupled circuits; applications of Laplace and Fourier transforms in circuit analysis; s-domain circuit analysis; Bode plots; and filters. **Prerequisites:** MATH 2332: Differential Equations, GEEN 2314: Circuits I, EEEN 2111: Circuits I Lab

EEEN 3331: Digital Systems - Also listed as COEN 3323: Digital Systems (2,1) This course addresses the understanding and design of digital systems. Topics progress through Boolean algebra and logic gates; combinational logic; sequential logic and synchronous sequential logic systems; and design of logic circuits. **Prerequisites:** GEEN 2314: Circuits I, EEEN 2111: Circuits I Lab

EEEN 3341: Signals and Systems - Also listed as COEN 3322: Signals and Systems (3,0) This course presents instruction in electrical signals and systems. Subject matter includes types of signals and systems, signal and system modeling, Fourier Series, Fourier Transform and applications, Laplace Transform and applications, state variable techniques, discrete time signals and systems. **Prerequisite:** EEEN 3312: Circuits II

EEEN 3361: Electromagnetic Fields and Waves (3,0) This course presents a study of electromagnetic fields and their relationship to problem solving in engineering. The course of study begins with the development of an understanding of the basics, moves to integration of the basic knowledge, and proceeds to the ability to use that knowledge to solve electromagnetic field problems using analysis, modeling, and simulation. **Prerequisites:** PHYS 1422: Physics for Engineers II, MATH 1324: Calculus III

EEEN 3391: Probability and Random Signal Analysis (3,0) This course covers probability, statistics, random variables, random signals, introduction to random processes, correlation functions and analysis of linear system response to random inputs and disturbances. Engineering applications to signal processing and linear system analysis also are included. **Prerequisite:** Concurrent registration in EEEN 3341: Signals and Systems

EEEN 3421: Electronics I - Also listed as COEN 3421: Electronics I (3,1) This course is the first of two courses in the use of electronic devices in analog and digital circuits. The lecture component covers device physics and modeling of op-amps, diodes, FETs, and BJTs; single and multi-stage amplifiers; differential amplifiers; feedback; frequency response; and Bode plots. The laboratory component covers generation and acquisition of signals; current, voltage, and impedance measurements; transfer function measurement; and spectrum measurements and analysis. **Prerequisites:** GEEN 2314: Circuits I, EEEN 2111: Circuits I Lab. Completion or concurrent registration for: EEEN 3312: Circuits II

EEEN 3422: Electronics II (3,1) This course is the second of two courses in the use of electronic devices in analog and digital circuits. Its lecture component covers analysis and design of operational amplifier circuits, D/A and A/D conversion, CMOS logic circuits, filters, oscillators and multivibrator circuits, power amplifiers, and pulse and switching circuits. The laboratory component covers the design and analysis of electronic circuits for digital and analog applications to a set of prescribed criteria. **Prerequisite:** EEEN 3421: Electronics I

EEEN 4311: Design Methodology and Project Management (3,0) This course presents an overview of engineering design designed to prepare students for ASSE 4311: Learning Outcome Assessment III, the final capstone course for engineering majors. Its subject matter is the entire product design process including project planning, quality function deployment, design specification, concept generation and selection, system and subsystem design, the role of engineering economics, the profession's codes and standards, and project management. **Prerequisites:** EEEN 3391: Probability and Random Signal Analysis, GEEN 3211: Engineering Economy

EEEN 4331: Microprocessors (2,1) This course presents the development of microprocessor systems with an introduction to assembly language programming. Instruction includes hardware-software interactions, programming techniques, and control of real-time hardware. Through the classes and labs, students are led to integrate knowledge into hands-on design and control applications. **Prerequisite:** EEEN 3331: Digital Systems

EEEN 4341: Communication Systems (2,1) This course presents a study of telecommunications theory and practice. Students develop competency in information theory; signals; systems; and analog modulation; digital data transmission; and error correcting codes. Methods of instruction include lecture, class discussion, and out-of-class assignments. **Prerequisites:** EEEN 3341: Signals and Systems, EEEN 3391: Probability and Ransom Signal Analysis

EEEN 4342: Digital Communication Systems (3,0) This course presents an overview of the field of digital communications. The learning experiences provide students with grounding in the underlying basic theory of digital modulation and coding. Instruction in the course makes use of computer simulation and problem solving to encourage students' ability in practical applications. **Prerequisite:** EEEN 4341: Communication Systems

EEEN 4343: Wireless Communication Systems (3,0) This course constitutes an introduction to wireless communications and networks. Students acquire an understanding of this technology's development and study transmission fundamentals, principles of operation, design, and issues current to the field. **Prerequisites:** EEEN 3361: Electromagnetic Fields and Waves, EEEN 4341: Communication Systems

EEEN 4351: Automatic Control Systems (2,1) This course introduces automatic control systems. The

elements of control systems are presented. Students progress through class activities and labs to apply knowledge through analysis and design of systems. The course includes mathematical modeling of systems. **Prerequisite:** EEEN 3312: Electric Circuits II

EEEN 4361: Electric Machinery (2,1) This course addresses the principles of electrical transformers and machinery, their analysis and design. Instruction begins with the basics of magnetic circuits and transformers and progresses through the study of electrical machinery, with an introduction to electrical power systems analysis. **Prerequisites:** EEEN 3312: Electric Circuits II, EEEN 3361: Electromagnetic Fields and Waves

EEEN 4371: Electric Power Systems (3,0) This course presents a study of electrical power systems, their analysis, operation, and design. Students are introduced to the fundamental concepts of the field. The class progresses through consideration of models to modern operations. Students consider issues and real-world problem analysis and solutions. **Prerequisites:** EEEN 4361: Electric Machinery, EEEN 4391: Advanced Applied Mathematics. Concurrent registration in EEEN 4372: Electric Power Transmission and Distribution

EEEN 4372: Electric Power Transmission and Distribution (3,0) This course addresses the principles of electrical power transmission and distribution. It covers analysis and design of overhead and underground transmission lines; electric and magnetic field profiles; medium and low voltage distribution systems; transformer connections; faults and selection of protective equipment. **Prerequisites:** EEEN 3361: Electromagnetic Fields and Waves, EEEN 4391: Advanced Applied Mathematics. Concurrent registration in EEEN 4371: Electric Power Systems

EEEN 4391: Advanced Applied Mathematics (3,0) This course covers engineering applications of ordinary and partial differential equations, Fourier and Laplace transforms, linear algebra; introduction to numerical analysis and complex variables. Mathematical modeling with applications to analysis and design of deterministic engineering systems also are included. **Prerequisites:** MATH 1324: Algebra III, MATH 2332: Differential Equations

General Engineering – GEEN

GEEN 1211: Introduction to Engineering (2,0) This course is an introduction to engineering and engineering design at the freshman level. The disciplines of civil, electrical, and mechanical engineering are defined. A systems approach to engineering design is used to solve open-ended engineering design problems related to civil, electrical, and mechanical engineering. Principles of teaming are emphasized throughout the course in accord with the design problem. **Prerequisite:** None

GEEN 2311: Statics and Dynamics of Rigid Bodies I (3,0) This course involves equilibrium of rigid bodies, resultants of force systems, centroids, and moments of inertia. Kinematics and kinetics of particles and rigid bodies also are covered. **Prerequisites:** PHYS 1421: Physics for Engineers I, MATH 1423: Calculus II

GEEN 2312: Introduction to Computing (3,0) This course is an introduction to computer systems, problem solving methods and algorithm development. Structured programming is taught using the programming language C, or C++, and JAVA. It includes designing coding, debugging and documenting programs using techniques of software development cycle. MATLAB, a tool that enables students to solve mathematical problems, is also taught. **Prerequisite:** MATH 1324: Calculus III

GEEN 2313: Thermodynamics I (3,0) This course introduces students to the concepts of heat and energy and how they relate and interact. Mass systems, control volumes, reversible and irreversible processes, open and closed systems, and open and closed cycles are covered. **Prerequisites:** MATH 1324: Calculus III, CHEM 1421: Chemistry for Engineers I, PHYS 1422: Physics for Engineers II

GEEN 2314: Circuits I - Also listed as COEN 2311: Circuits I (2,1) This course covers important theory in DC and AC circuits analysis. Topics include a review of the solution of simultaneous equations; Kirchoff's Current and Voltage Laws; nodal and mesh circuit analysis; superposition; source transformations; Thevenin and Norton Equivalent circuits; ideal op-amps; and RC, RL, and RLC circuits. **Prerequisites:** MATH 1324: Calculus III, PHYS 1422: Physics for Engineers II. Concurrent registration in COEN 2111: Circuits Lab. Completion of or Concurrent registration in MATH 2332: Differential Equations.

GEEN 3211: Engineering Economy (2,0) This course teaches the basic principles and techniques of economic analysis and cost engineering. Applications are made to real engineering problems and processes. The use of economics in evaluating engineering designs is emphasized. **Prerequisite:** GEEN 3311: Introduction to Fluid Mechanics

GEEN 3311: Introduction to Fluid Mechanics (3,0) This course introduces students to the concepts of fluid statics and fluid dynamics. Fluid statics refers to a fluid at rest and the forces which act on the fluid in that state. Fluid dynamics refers to a fluid in motion and the forces that act on the fluid in that state. **Prerequisite:** GEEN 2313: Thermodynamics I

Mechanical Engineering – MEEN

MEEN 2211: Materials Engineering 2 (2,0) This course examines the relationships between material structure and the mechanical, electrical, magnetic, thermal, and optical properties of materials. The macroscopic properties of materials are discussed in relation to the microscopic properties.

Prerequisites: CHEM 1421: Chemistry for Engineers I, PHYS 1421: Physics for Engineers I, MATH 1324: Calculus III

MEEN 2312: Statics and Dynamics of Rigid Bodies II (3,0) This course is a continuation of GEEN 2311: Statics and Dynamics I, covering topics including moments of inertia for areas, principles of work and energy, angular momentum, planar kinematics, and vibrations normally covered in a traditional two-course sequence of Statics and Dynamics. **Prerequisites:** GEEN 2311: Statics and Dynamics I, MATH 1324: Calculus III

MEEN 2313: Mechanics of Solids (3,0) This course covers applications of conservation principles and stress/deformation relationships to solid bodies. It draws upon the principles from Statics and Dynamics I, physics, and mathematics courses. **Prerequisites:** GEEN 2311: Statics and Dynamics of Rigid Bodies, MATH 1324: Calculus III

MEEN 2311: Introduction to Manufacturing Systems (2,0) This course introduces mechanical engineering majors to modern manufacturing processes and their integration into a total manufacturing system. The course covers modern manufacturing processes including computer application in manufacturing, flexible manufacturing systems, and robotics, as they apply to the various manufacturing options. **Prerequisites:** MEEN 2211: Materials Engineering, GEEN 2312: Introduction to Computing

MEEN 3212: Manufacturing Methods in Design (2,0) This course builds on materials science and introductory coursework in manufacturing processes to focus on materials selection and alteration of materials properties. It provides a special emphasis on design and manufacturability. **Prerequisites:** MEEN 2211: Materials Engineering and MEEN 3211: Introduction to Manufacturing Systems. Concurrent registration in MEEN 2313: Mechanics of Solids

MEEN 3322: Thermodynamics II (3,0) This course continues the introduction to concepts of thermodynamics begun in GEEN 2313: Thermodynamics I. Topics cover thermodynamic cycles including power, propulsion, and refrigeration cycles and associated machinery. **Prerequisites:** GEEN 2313: Thermodynamics I. Concurrent registration in GEEN 3311: Introduction to Fluid Mechanics

MEEN 3332: Computational Methods (3,0) In this course, students acquire knowledge about tools that are available for analysis of engineering problems, and they learn to apply these tools effectively. Topics include Taylor series, numerical integration and differentiation, non-linear algebraic equations; boundary value problems; finite difference solutions; and finite element solutions of ordinary differential equations. **Prerequisites:** GEEN 2312: Introduction to Computing, MATH 2332: Differential Equations

MEEN 3333: Heat Transfer (3,0) This course introduces the concepts of heat transfer, including conduction, convection, and radiation. Students learn to solve problems concerning transfer across solid surfaces, heat transfer through moving and stationary fluids, and heat transfer through space. **Prerequisites:** GEEN 2313: Thermodynamics I, GEEN 3311: Introduction to Fluid Mechanics

MEEN 3391: Mechanical Engineering Design I (3,0) This course is the first course in the Mechanical Engineering design sequence. It introduces students to the concepts of design and the design process. An additional focus is on kinematics, linkages, and an introduction to mechanisms. **Prerequisites:** MEEN 2312: Statics and Dynamics II, MATH 2332: Differential Equations

MEEN 3392: Mechanical Engineering Design II (3,0) This course is the second course in the mechanical engineering design sequence. It introduces students to the concepts of the control of dynamical systems. In this course, students learn to solve control problems for both steady-state and transient responses. The student is expected to have a thorough understanding of Design 1. **Prerequisites:** MEEN 3332: Computational Methods, MEEN 3391: Engineering Design I

MEEN 3393: Mechanical Engineering Design III (3,0) This course is the third course in the mechanical engineering design sequence. It introduces students to the concepts of mechanical strength and reliability in the design of machine components. Stress, reliability, and failure analysis are considered. **Prerequisites:** MEEN 3392: Mechanical Engineering Design II, MEEN 3332: Computational Methods, MEEN 2313: Mechanics of Solids

MEEN 4301: Mechanical Engineering Lab I (1,2) This laboratory course introduces students to the concepts of engineering measurement and experimentation in the thermal sciences. It develops physical understanding through experimentation as students analyze raw data and organize the results into a comprehensive lab report. **Prerequisites:** GEEN 3311: Introduction to Fluid Mechanics, MEEN 3322: Thermodynamics II, MEEN 3333: Heat Transfer

MEEN 4302: Mechanical Engineering Lab II (1,2) This laboratory course introduces students to the concepts of engineering measurement and experimentation in mechanics, mechanisms, and controls. Students are exposed to experiments and techniques in the various areas as they develop physical understanding through experimentation. **Prerequisites:** MEEN 2313: Mechanics of Solids, MEEN 3393: Engineering Design III

MEEN 4311: Principles of Heating, Ventilating, and Air Conditioning (HVAC) (3,0) This course is an

application of thermodynamics, fluid mechanics, and heat transfer to the design and selection of HVAC equipment. It covers psychometrics, thermodynamic cycles, HVAC components, and piping and duct layouts, pumps, and fans in a lecture format. **Prerequisites:** GEEN 3311: Introduction to Fluid Mechanics, MEEN 3322: Thermodynamics II, MEEN 3333: Heat Transfer

MEEN 4312: Fluid Mechanics (3,0) This course introduces students to additional topics in fluid dynamics. Piping systems are studied in series and in parallel. Boundary layers and bluff body flows are studied to determine how to calculate drag and lift on smooth and bluff bodies. Flow through fluid machinery is studied to learn the fundamentals of the design of fluid machinery. Compressible flow is studied to learn the effects of compressibility on fluid flow. **Prerequisites:** GEEN 3311: Introduction to Fluid Mechanics, MEEN 3322: Thermodynamics II

MEEN 4315: Principles of Building Energy Analysis (3,0) This course uses current ASHRAE building load calculation methods to analyze building energy use. Both the heat balance (HB) and radiant time series (RTS) methods are used to calculate building loads. The course uses competencies from thermodynamics, heat transfer, and mathematics courses, and complements the MEEN 4311: Principles of HVAC course. Either the building energy analysis course or the HVAC course may be taken first. **Prerequisites:** MEEN 3322: Thermodynamics II, MEEN 3333: Heat Transfer

MEEN 4322: Power Generation (3,0) This course provides a broad knowledge of systems in modern power plants and is an application of engineering sciences, principally thermodynamics and fluid mechanics. The energy conversion process is emphasized, with concentration on gas turbine combined cycle plants and traditional oil or gas-fired power generation. **Prerequisites:** GEEN 3311: Introduction to Fluid Mechanics, MEEN 3322: Thermodynamics II, MEEN 3333: Heat Transfer

MEEN 4331: Internal Combustion Engines (3,0) This course is an application of the thermal sciences applied to internal combustion engines. The thermodynamic engine cycle is reviewed and intake and exhaust processes are covered. Both spark-ignition (the Otto cycle) and compression-ignition (the Diesel cycle) engines are analyzed. **Prerequisites:** MEEN 3322: Thermodynamics II, MEEN 3333: Heat Transfer

MEEN 4332: Turbomachinery (3,0) This course applies the thermal sciences to the design of pumps, fans, compressors, and turbines. Similarity and scaling laws are developed. Radial and axial flow machines are analyzed. Blade design for both pumps and turbines are considered. Design of centrifugal pumps and axial flow compressors is studied. **Prerequisites:** MEEN 3322: Thermodynamics II. Concurrent registration in MEEN 3333: Heat Transfer

MEEN 4341: Corrosion Engineering (3,0) This course covers the causes and mechanisms of aqueous corrosion, including electrochemistry and thermodynamics of corrosion. Materials selection and design for minimization of corrosion, as well as corrosion protection are included. Selected case studies are discussed. **Prerequisites:** MEEN 3322: Thermodynamics II, MEEN 2211: Materials Engineering

MEEN 4344: Materials in Design (2,1) This course ties together material selection, properties, and manufacturing processing to support the performance requirements specified by a design. **Prerequisites:** MEEN 3212: Manufacturing Methods in Design. Concurrent registration in MEEN 3393: Mechanical Engineering Design III

MEEN 4351: Intermediate Dynamics (3,0) This course is a senior elective course for Mechanical Engineering students. The purpose of the course is to have the students develop an understanding of the fundamentals of analytical dynamics and its applications mechanical systems. The student is expected to have a thorough understanding of vectorial mechanics and the dynamics of rigid bodies to be successful in this course. This course is a lecture course; no laboratory is included. **Prerequisites:** MEEN 2312 Statics and Dynamics II, MEEN 3391 Mechanical Design I

MEEN 4392: Advanced Control Systems (3,0) This course covers mathematical modeling, analysis, design, and synthesis of systems, including mechanical, electrical, hydraulic and thermal subsystems. Topics include Newtonian mechanics, multiple degrees of freedom vibrations, and control system design. **Prerequisites:** MEEN 3332: Computational Methods, MEEN 3392: Engineering Design II