ME 2900 Creative Inquiry in Mechanical Engineering

I 1-3 (1-3) Students work in extended teams (including sophomores, juniors, seniors, and graduate students) addressing research and development problems under the supervision of a faculty lead. Engineering principles and best practices will be employed. Team work, professionalism, and communication skills are emphasized. May be repeated for a maximum of nine credits. Prereq: consent of instructor.

ME 3040 Heat Transfer 3 (3) Study of steady and transient heat conduction, free and forced convection, radiation, and multi-mode heat transfer. Emphasizes analytical and numerical solutions to engineering heat transfer problems with a design orientation. Prereq: MATH 2080 and ME 2080 each with a C or better. Prereq or concurrent enrollment: MATH 3650 with a C or better.

ME 3320 Thermodynamics 3 (3) Study of the second law and entropy. Includes applications to fixed mass systems and control volumes; vapor and gas power cycles; mixtures of gases; vapor psychrometrics; combustion and the third law. thermochemical equilibrium. Prereq: MATH 2030 with a C or better.

ME 3020 Computational Fluid Dynamics 3 (3) Emphasis on detailed solutions to fluid dynamics problems in aerospace, manufacturing, and environmental applications. Prereq: MATH 2080 and PHYS 2210, each with a C or better. Prereq or concurrent enrollment: MATH 3650 with a C or better.

ME 3050 Modeling and Analysis of Dynamic Systems 3 (3) Presents techniques for developing and analyzing models of mechanical, electrical, electromechanical, fluid and thermal systems. Transient, steady-state and frequency response are determined using analytical and numerical methods. Covers tools for stability analysis and state-space representation. Covers linear free- and forced-vibrations in single- and multi-degree-of-freedom systems with lumped-parameters representation, methods of vibration absorption and isolations. Prereq: ECE 2070 and ECE 2080 or MATH 2080 and MATH 3650, each with a C or better. Prereq or concurrent enrollment: ME 3070 with a C or better.

ME 3060 Fundamentals of Machine Design 3 (3) Introduction to failure theory and fatigue analysis. Integration of these topics with selected portions of mechanisms of materials and application of them to the design and analysis of machine elements. Prereq: MATH 2040 and ME 3070, each with a C or better. Prereq or concurrent enrollment: MATH 3650, with a C or better.

ME 3070 Foundations of Mechanical Sciences 3 (3) Introduction to physical elements and mechanisms that define basic mechanical engineering systems. Application of kinematic and kinetic analysis to mechanisms and the role of design in mechanisms. Prereq: MATH 2010 with a C or better. Prereq or concurrent enrollment: ME 2040 with a C or better.
ME 3080 Fluid Mechanics 3 (3) Behavior of fluids at rest or in motion, including the study of fluid properties. Emphasizes a rational, analytical approach from which are developed basic principles of broad applicability to all fields of engineering. Includes Honors sections. Prq: ME 2010 and ME 2030, each with a C or better. Prq or concurrent enrollment: MATH 2080 with a C or better.

ME 3100 Thermodynamics and Heat Transfer 3 (3) Introduction to thermodynamics and heat transfer for nonmajors: properties of liquids and gases, first and second law analysis, introduction to cycles for power and refrigeration, heat flow by conduction and radiation, and convective heat flow and heat exchangers. Prq: MATH 2060 and PHYS 2210, each with a C or better, and enrollment in an engineering curriculum other than Mechanical Engineering.

ME 3120 Manufacturing Processes and Their Application 3 (3) Fundamental principles associated with production processes and their application to the manufacture of products from metals, polymers, ceramics, and composites. Emphasizes the physical and quantitative aspects of processing, the selection of processes to create products, and the identification processes used to manufacture existing products. Prq or concurrent enrollment: ME 3040 and ME 3060 and ME 3330, each with a C or better.

ME 3330 Mechanical Engineering Laboratory II 2 (6) Mechanical engineering principles and phenomena are reinforced through student conducted experiments. Presentation of fundamentals of instrumentation, calibration techniques, data analysis, and report writing in the context of laboratory experiments. Prq: MATH 2080 and ME 2030 and ME 2220, each with a C or better.

ME 3900 Creative Inquiry in Mechanical Engineering II 1-3 (1-3) Students work in extended teams (including sophomores, juniors, seniors, and graduate students) addressing research and development problems under the supervision of a faculty lead. Engineering principles and best practices will be employed. Team work, professionalism, and communication skills are emphasized. May be repeated for a maximum of nine credits. Includes Honors sections. Prq: Consent of instructor.

ME 4000 Senior Seminar 1 (1) Seminars address the problems encountered by engineering graduates in professional practice. Invited lecturers as well as faculty provide the lectures and demonstrations. Prq or concurrent enrollment: ME 4010 with a C or better.

ME 4010 Mechanical Engineering Design 3 (3) Project-oriented course in mechanical engineering emphasizing the role of analysis, synthesis, and evaluation in design and on written reporting of design solutions. Influence of economics and optimization, concurrent development, integration of design and manufacturing, and system creation are utilized for engineering design decisions. Prq: ENGL 3140 and ME 3030 and ME 3040 and ME 3050 and ME 3060, each with a C or better (concurrent enrollment in one of the preceding ME courses is permitted, but student must request a prerequisite override from the undergraduate coordinator). Prq or concurrent enrollment: ME 3120 with a C or better.

ME 4020 Internship in Engineering Design 3 (1) Creative application of general engineering knowledge in solving an open-ended design problem provided by a sponsor typically external to the University. Progress is evaluated by a faculty jury. Students present results to the jury and sponsor through written reports and oral presentations addressing University written/oral competency goals. Students must have completed all required 3000-level ME courses before enrolling in this course. Prq: ME 4010 with a C or better. Coreq: ME 4021.

ME 4021 Internship in Engineering Design Laboratory 0 (3) Non-credit laboratory to accompany ME 4020. Coreq: ME 4020.

ME 4030 Control and Integration of Multidomain Dynamic Systems 3 (3) Introduction of control theory with sensor, actuator, and dynamic plant integration to develop, model, control, and analyze mathematical models of dynamic systems, including mechanical, electrical, electromechanical, hydraulic and pneumatic systems. Transient dynamics are determined using analytical and numerical methods with feedback control systems. Strong emphasis is placed on system design using computer simulation tools. Prq: ME 3050 with a C or better.

ME 4150 Undergraduate Research 1-3 (1-3) Individual research projects conducted under the direct supervision and guidance of a faculty member. May be repeated for a maximum of six credits. Includes Honors sections. Prq: Consent of instructor.

ME 4170* Mechatronics System Design 3 (2) Mechatronics integrates control, sensors, actuators, and computers to create a variety of electromechanical products. Includes concepts of design, appropriate dynamic system modeling, analysis, sensors, actuating devices, and real time microprocessor interfacing and control. Laboratory experiments, simulation, and design projects are used to exemplify the course concepts. Prq: ME 3050 with a C or better. Coreq: ME 4171.

ME 4171 Mechatronics System Design Laboratory 0 (3) Non-credit laboratory to accompany ME 4170. Coreq: ME 4170.

ME 4180 Finite Element Analysis in Mechanical Engineering Design 3 (2) Introduction to the finite element method and solid modeling, finite element modeling and analysis using commercial codes; analysis strategies using finite elements; applications to heat transfer, fluid flow, and structures. Prq: ME 2040 and ME 3040 and ME 3080, each with a C or better. Coreq: ME 4181.

ME 4181 Finite Element Analysis in Mechanical Engineering Design Laboratory 0 (1) Non-credit laboratory to accompany ME 4180. Coreq: ME 4180.

ME 4200* Energy Sources and Their Utilization 3 (3) Covers availability and use of energy sources such as fossil fuels, solar (direct and indirect), and nuclear; addresses energy density and constraints to use (technical and economic) for each source. Prq: ME 3030 and ME 3040, each with a C or better.

ME 4210* Introduction to Compressible Flow 3 (3) Introductory concepts to compressible flow; methods of treating one-dimensional gas dynamics including flow in nozzles and diffusers, normal shocks, moving and oblique shocks, Prandtl-Meyer Flow, Fanno Flow, Rayleigh Flow, and reaction propulsion systems. Prq: ME 3030 and ME 3080, each with a C or better.

ME 4220* Design of Gas Turbines 3 (3) Guiding principles in gas turbine cycles are reviewed. Turbine and compressor design procedures and performance prediction for both axial and radial flow machines are presented. Methods of design of rotary heat-exchangers and retrofitting gas turbine for regenerative operation are presented. Design projects are used to illustrate the procedures. Prq: ME 3080 with a C or better.

ME 4230* Introduction to Aerodynamics 3 (3) Basic theories of aerodynamics are presented for the purpose of accurately predicting the aerodynamic forces and moments which act on a vehicle in flight. Prq: ME 3080 with a C or better.

ME 4250 Aircraft Conceptual Design 3 (3) This course develops the aspects involved in the conceptual design of an aircraft. Focus is on the interplay between goals and constraints in the process of the design of a subsonic aircraft. Prq: ME 3080.

ME 4260* Nuclear Energy 3 (3) Engineering methods and science principles are considered for the design of components to nuclear power stations. A systems level understanding is emphasized. Includes nuclear fuel cycle and regulatory considerations. Prq: CE 3410; or CEE 3210; or EES 3100; or both ME 3030 and ME 3040; or ME 3100; or MSE 3270; or PHYS 3220; each with a C or better.

ME 4280 Thermal-Hydraulics of Nuclear Reactors 3 (3) Provides the mechanical engineer with the basic concepts required to understand the thermal-hydraulic behavior of nuclear reactors in normal operating conditions. Prq: ME 3040 with a C or better.

ME 4290* Thermal Environmental Control 3 (3) Mechanical vapor compression refrigeration cycles, refrigerants, thermoelectrical cooling systems, cryogenics, thermodynamic properties of air, psychrometric charts, heating and cooling coils, solar radiation, heating and cooling loads, insulation systems. Prq: ME 3030 and ME 3080, each with a C or better.


ME 4310 Applied Fluids Engineering 3 (3) Applications-oriented course in industrial fluids engineering, primarily directed toward the analysis and design of piping systems and components for liquid and gas flow. Topics include friction factors, head loss, (flow capacities, piping networks, flow measurement, pumps, control valves, and hydraulic and pneumatic components. Prq: ME 3080 and ME 3330, each with a C or better.
then optimize before prototyping it. Emphasizes the engineering aspects of select- materials for applications in aggressive environments. Various types of materials degradation are discussed as are methods for wastage prevention, including especially engineering design and materia- ls selection approaches. Structural metallic alloys are emphasized; however, technically important ceramics and polymers are also discussed. Preq: ME 3060 with a C or better.

**ME 4440 Mechanical Engineering Laboratory III 2 (6)** Continuation of ME 3330. Mechanical engineering principles and phenomena are rein- forced through student-conducted experiments. Presentation of fundamentals of instrumentation, calibration techniques, data analysis, and report writing in the context of laboratory experiments. Preq: ME 3330; and MATH 3020 or STAT 4110, each with a C or better. Preq or concurrent enrollment: ME 3060 with a C or better.

**ME 4530 Dynamic Performance of Vehicles 3 (3)** Introduces techniques for analyzing the dy- namic behavior of vehicles. Types of vehicles to be considered are chosen from aircraft, surface ships, automobiles and trucks, railway vehicles, and magnetically levitated vehicles. Preq: ME 3050 with a C or better.

**ME 4540 Design of Machine Elements 3 (3)** Design of common machine elements including clutches, brakes, bearings, springs, and gears. Optimization techniques and numerical methods are employed as appropriate. Preq: ME 3060 with a C or better.

**ME 4550 Design for Manufacturing 3 (3)** Concepts of product and process design for automated manu- facturing are considered. Topics include product design for automated manufacturing, inspection and assembly, using automation, industrial robots, knowledge-based systems and concepts of flexible product manufacture. Preq: ME 3060 with a C or better. Preq or concurrent enrollment: ME 3120 with a C or better.

**ME (ECE) 4570 Fundamentals of Wind Power 3 (3)** Introduces wind turbine systems, including wind energy potential and application to power genera- tion. Topics include wind energy principles, wind site assessment, wind turbine components, power generation machinery control systems, connection to the electric grid, and maintenance. May also be offered as ECE 4570. Preq: ECE 2070 or ECE 3200, with a C or better.

**ME 4710 Computer-Aided Engineering Analysis and Design 3 (2)** Students are exposed to geometric and solid modeling, finite elements, optimization, and rapid-prototyping. Students design an artifact, represent it on the computer, analyze it using FEA, then optimize before prototyping it. Emphasizes the use of computer-based tools for engineering design. Preq: ENGR 1090 and ME 2020, each with a C or better. Coreq: ME 4711.

### MANAGEMENT

**MG 2180 Management Personal Computer Applications 3 (3)** Personal computer applications that support managers. Students learn from hands-on work rather than lecture.

**MG 2970 Creative Inquiry—Management 1-3 (1-3)** Students plan, develop, and execute a research project related to the field of management and present their findings. The development of the project includes lectures about research design, conduct, and data analysis. May be repeated for a maximum of six credits. Includes Honors sections.

**MG 3050 Economics of Transportation 3 (3)** Topics include history and structure of transpor- tation systems in the United States, the nature of transportation costs and rates, transportation systems as factors in industrial location, transpor- tation policy, and the role of transportation in national security. Preq: Junior standing.

**MG (ECON) 3060 Managerial Economics 3 (3)** Uses tools of economic analysis in classifying prob- lems in organizing and evaluating information, and in comparing alternative courses of action. Bridges the gap between economic theory and managerial practices. May not be used to satisfy requirements for a degree in Economics. May also be offered as ECON 3060. Preq: ECON 2110.