Mechanical Engineering

John C. Crepeau, Dept. Chair, Dept. of Mechanical Engineering (324I Engineering/Physics Bldg. 83844-0902; phone 208/885-4279).

Note: Pre-advising is required for all mechanical engineering courses; consult the department office to be assigned to an advisor.

ME 123 Introduction to Mechanical Design (3 cr)
Introduction to engineering design process and analysis techniques including problem solving skills, development of software learning skills, graphical analysis, data analysis, economic decision making, documentation skills, and use of structured programming concepts in designing personal applications. Three lec and one open 2-hr lab a wk. (Fall only)
Coreq: Math 143 or 170

ME 223 Mechanical Design Analysis (3 cr)
Use of a design and problem solving methodology in the creation of application programs; matrix methods; numerical integration; solution of differential equations; oral/written communication. Three lec and one 2-hr open lab a wk.
Prereq: ME 123
Coreq: Math 175

ME 301 Computer Aided Design Methods (3 cr)
Two and three dimensional graphics including geometric dimensioning and tolerancing (GDT); use of solid modeling software in engineering design (CAD); finite element analysis (FEA), and manufacturing (CAM).
Prereq: ME 223

ME 307 Group Mentoring I (1 cr)
Mentoring of student groups in engineering classes where a process education environment is used; students taking this course will improve their engineering skill in the area they are mentoring as well as improving their team, communication, and leadership skills. Students must attend all classes or labs where group activities in the process education environment are done (a minimum of 2 mentoring sessions per week).
Prereq: Permission

ME 308 Group Mentoring II (1 cr)
Mentoring of student groups in engineering classes where a process education environment is used; students taking this course will improve their engineering skill in the area they are mentoring as well as improving their team, communication, and leadership skills. Students must attend all classes or labs where group activities in the process education environment are done (a minimum of 2 mentoring sessions per week).
Prereq: Permission

ME 313 Dynamic Modeling of Engineering Systems (3 cr)
Application of basic engineering principles to model and analyze the dynamic response of engineering systems; problem solutions will utilize transfer function methods, state variable techniques, and simulation software.
Prereq: ME 223, Engr 220, Engr 240, and Math 310
Coreq: Math 330

ME ID&WS324 Dynamic Analysis in Machine Design (3 cr) WSU M E 312
Kinematic, static, and dynamic principles and application to analysis and synthesis of machines with emphasis on computer-aided design (CAD) techniques. Two lec and one 3-hr lab a wk; one 1-day field trip.
Prereq: Math 310, Engr 220, and ME 223
Coreq: Math 330

ME 325 Machine Component Design I (3 cr)
Study of stress, deflection and stiffness, material properties, static and fatigue failure theory in the context of the analysis and design of machine components such as fasteners, welds, spring design and bearings.
Prereq: ME 341 and MSE 201

ME 330 Experimental Methods for Engineers (3 cr)
Measurement systems and their application to engineering problems; topics include generalized performance of measurement systems, measuring and control devices, data acquisition and analysis, and report writing. Two lec and one 2-hr lab a wk.
Prereq: ME 223
Coreq: Engr 240, 320, 335, and 350

ME 341 Intermediate Mechanics of Materials (3 cr)
Mechanics of materials approach to three dimensional stress and strain, plates, curved beams, pressure vessels, non-circular torsion and unsymmetrical ending; introduction to elementary energy methods and advanced strength theories.
Prereq: Engr 350, Math 275, 310

ME ID&WS345 Heat Transfer (3 cr) WSU M E 404

Transmission by conduction of heat in steady and unsteady states, by free and forced convection, and by radiation; combined effects of conduction, convection, and radiation.
Prereq: ME 223, Engr 320, and Math 310

ME 398 (s) Engineering Cooperative Internship I (cr arr)
Supervised internship in professional engineering settings, integrating academic study with work experience; requires written report to be evaluated by a designated faculty member; details of coop to be arranged with ME Department before start of coop; cannot be counted as a technical elective. Graded P/F.
Prereq: Permission

ME 399 (s) Engineering Cooperative Internship II (cr arr)
Supervised internship in professional engineering settings, integrating academic study with work experience; requires written report to be evaluated by a designated faculty member; details of coop to be arranged with ME Department before start of coop; cannot be counted as a technical elective. Graded P/F.
Prereq: Permission

ME 401 (s) Engineering Team Projects (2-3 cr, max arr)
Students will employ a systems approach to designing, testing, building and delivering an interdisciplinary engineering project. Projects are chosen at the discretion of the department.
Prereq: ME Certification and Permission

ME 404 (s) Special Topics (cr arr)

ME 407 Group Mentoring III (1 cr)
Mentoring of student groups in engineering classes where a process education environment is used; students taking this course will improve their engineering skill in the area they are mentoring as well as improving their team, communication, and leadership skills. Student must attend all classes or labs where group activities in the process education environment are done (a minimum of 2 mentoring sessions per week).
Prereq: Permission

ME 408 Group Mentoring IV (1 cr)
Mentoring of student groups in engineering classes where a process education environment is used; students taking this course will improve their engineering skill in the area they are mentoring as well as improving their team, communication, and leadership skills. Student must attend all classes or labs where group activities in the process education environment are done (a minimum of 2 mentoring sessions per week).
Prereq: Permission

ME 410 Principles of Lean Manufacturing (3 cr)
Principles of lean manufacturing are introduced that provide a systematic process for identifying and eliminating non-value activities (waste) in production processes. Students learn these principles through a series of workshops, lectures, and hands-on simulations of lean principles. Three hours of lec and six hours of outside work per week.
Prereq: Sr standing in an engineering discipline or Permission

ME 411 Advanced Lean Manufacturing (3 cr)
Principles of lean manufacturing are applied in a systematic way for identifying and eliminating non-value activities (waste) introduction processes. Students learn how to identify the value stream in a company and techniques for engineering continuous improvement. These techniques are learned through a series of workshops, lectures, readings, and on-site industrial projects. Three hours of lec and six hours of outside work a week.
Prereq: ME 410

ME 412 Gas Dynamics (3 cr)
Compressible flow in ducts and nozzles, shock waves and expansion waves, and adiabatic two-dimensional compressible flow.
Prereq: Math 310, Engr 320, and Engr 335

ME J413/ID-J513 Engineering Acoustics (3 cr) WSU ME 523
ME 513 same as ECE 579. Fundamentals of acoustics including wave theory; transmission through layers, generation and reception; low frequency models; application to sound measurement, transducers, loudspeaker cabinet design, and nondestructive testing; acoustic design project reqd. Additional projects/assignments reqd for grad cr.
Prereq: Engr 240 or ECE 212, and Math 310, or ME 313

ME J414/J514 HVAC Systems (3 cr)
Application of thermodynamics, heat transfer, and fluid flow to understanding the psychrometric performance of systems and equipment; evaluating the performance characteristics, advantages, and disadvantages of the various types of HVAC systems including large tonnage refrigeration/chiller equipment, cooling coils, cooling towers, ducts, fans, and heat pump systems; economics of system and equipment selection. Recommended Preparation: ME 345, ME 444.

ME 415 Materials Selection and Design (3 cr)
See MSE 415.

ME J417/J517 Turbomachinery (3 cr)
Introduction to the basic principles of modern turbomachinery. Emphasis is placed on steam, gas (combustion), wind and hydraulic turbines. Applications of the principles of fluid mechanics, thermodynamics and aerodynamics to the design and analysis of turbines and compressors are incorporated. Additional technical research report and presentation reqd for grad cr. Recommended Preparation: Engr 320, Engr 335.

ME J418/J518 Discrete System Simulation and Animation (3 cr)
How to model discrete systems such as those found in manufacturing. A non-procedural computer language for writing computer code will be taught. Topics include inventory control, scheduling, and optimization; animation of simulation results. Special software for the animation will be covered. Additional exercises and a major term project required for graduate credit.
Prereq: ME 418: Junior status or Permission ME 518: Permission

ME 419 Advanced Simulation and Animation (3 cr)
Advanced topics in discrete system simulation with emphasis on topics of interest to the Mechanical Engineer. Students will learn how to model complex discrete systems using special software for both simulation and animation. Topics include: interfacing the simulation language with other software, creating stand-alone animations, creating presentations showing the animation results. Each student will be assigned a major project to simulate. (Spring only)
Prereq: ME 418

ME J420/J520 Fluid Dynamics (3 cr)
Same as CE J420/J520. Cr not granted for both ME 420 and ME 520. A second fluid dynamics course featuring vector calculus and integral and differential forms of the conservation laws. Topics include fluid properties, fluid statistics, inviscid flow; conservation of mass, momentum, and energy; and turbulence. Other topics may be covered. Additional projects/assignments reqd for grad cr.
Prereq: Engr 335, Math 310, or Permission

ME J421/J521 Advanced Computer Aided Design (3 cr)
Use of solid modeling software for advanced component design, creation of complex multi-component assemblies, animation studies, and rendering. There are two major projects: solid modeling to reverse engineer an existing design and solid modeling for detail design synthesis.
Prereq: ME 301 and 341

ME 422 Applied Thermodynamics (3 cr)
Advanced topics in applied thermodynamics including availability (exergy) analysis of systems, advanced power and refrigeration cycles, combustion, thermodynamic properties of real fluids, phase equilibrium, and chemical equilibrium.
Prereq: Engr 320

ME 424 Mechanical Systems Design I (3 cr)
May be used as core credit in J-3-d. Study of production realization process including project planning, concept design, detail design, and manufacturing processes; modern design and manufacturing practices in each of these areas applied to a two-semester, industrial sponsored capstone design project (continued in ME 426). (Fall only)
Prereq: ME 301, 313, 324, 325, 330, 345, and Certification

ME 425 Machine Component Design II (3 cr)
Emphasis on material selection, machineability, joining, materials strengthening and surface treatment; design using metals, non metals and composite materials for strength, fatigue, creep and corrosion resistance; other topics include lubrication theory. Discussions of case studies and detailed design projects involving machine component elements.
Prereq: ME 325

ME 426 Mechanical Systems Design II (3 cr)
May be used as core credit in J-3-d. Continuation of ME 424. Additional manufacturing issues; continuation of a two-semester, industrial sponsored capstone design project (begun in ME 424) to include the detail design, prototype construction, and testing. (Spring only)
Prereq: ME 424
Coreq: ME 435

ME 428 Computer Aided Simulation (3 cr)
The course focuses on extending student knowledge of numerical simulation in the area of mechanics, heat transfer and fluid flow. The focus will be on both the theory and application using the computer with current methodologies. The focus will be on finite elements, boundary elements, and finite differences.
Prereq: ME 301, ME 345, Engr 335 and Engr 350

ME 430 Senior Lab (3 cr)
Detailed lab investigation of engineering problem; statistical design of experiments; application of engineering principles to analyze experimental data; technical report writing; oral communication skills. One lec and four hrs of lab a wk.
Prereq: ME 313 and 330
Coreq: Engl 317

ME 433 Combustion Engine Systems (3 cr)
Theory and characteristics of combustion engines; combustion process analysis; fuels, exhaust emissions and controls; system analysis and modeling.

Coreq: ME 345 or Permission

ME 435 Thermal Energy Systems Design (3 cr)
Application of fluid mechanics, thermodynamics and heat transfer in the design of thermal energy systems; topics include thermal energy system component analysis and selection, component and system simulation, dynamic response of thermal systems, and system optimization. (Fall only)
Prereq: Engr 335 and ME 345
Coreq: Math 330

ME J443/J543 (s) Analysis of Thermal Energy Systems (3 cr, max arr)
Analysis of thermal energy systems; topics vary depending on instructor and may include one or more of the following thermal systems: solar energy, refrigeration, vapor power generation, gas power generation, geothermal energy, wind energy, fuel cells, nuclear energy, thermoelectric systems, and thermionic systems. Additional assignments and a technical research report required for graduate credit.
Prereq: Engr 335 and ME 345; permission required to repeat course for credit

ME ID&WS444 Air Conditioning Engineering (3 cr) WSU M E 419
Requirements for air conditioned spaces for human comfort; thermodynamic properties of air-water vapor mixtures; heating and cooling loads; design of systems for heating, cooling, and ventilation.
Prereq: ME 345

ME J451/J551 Experimental Methods in Fluid Dynamics and Heat Transfer (3 cr)
Credit not granted for both ME 451 and ME 551. Theory and applications of transducers and instrumentation to measure velocity, temperature, and related quantities; flow visualization, pressure measurements, thermal anemometry, laser Doppler velocimetry, temperature and concentration measurement, and heat flux measurement. Additional projects/assignments reqd for grad cr. One 1-1/2 hr lec and one 3-hr lab a wk. Recommended Preparation: Engl 317, ME 345.
Prereq: ME 330

ME 461 Fatigue and Fracture Mechanics (3 cr)
Fracture mechanics approach to structural integrity, fracture control, transition temperature, microstructural and environmental effects, fatigue and failure analysis.
Prereq: Engr 350

ME ID&WS472 Mechanical Vibrations (3 cr) WSU M E 449
Free and forced vibration of single and multiple degree of freedom systems; response of mechanical systems to inputs of varying complexity, ranging from single frequency to pseudo-random; applications to mechanical design and vibration control.
Prereq: Engr 220, Math 310, and ME 313; or Graduate standing

ME ID&WS481 Control Systems (3 cr) WSU M E 481
Same as ECE 470. Analysis and design of feedback control systems utilizing frequency and time domain methods, and computer-aided design tools.
Prereq for Electrical Engineering and Computer Engineering majors: ECE 350
Prereq for Mechanical Engineering majors: ME 313

ME 499 (s) Directed Study (cr arr)
Selected topics. Detailed report required.
Prereq: Senior standing and Permission

ME 500 Master's Research and Thesis (cr arr)

ME 502 (s) Directed Study (cr arr)
Supervised study, including critical reading of current literature.
Prereq: Permission

ME 503 (s) Workshop (cr arr)

ME 504 (s) Special Topics (cr arr)

ME 508 Mechanics of Plates and Shells (3 cr)
Formulation of governing equations, assumptions, stress analysis, calculation of displacements, discussion of experimental analysis, buckling and vibration of plates and shells.
Prereq: ME 341 or CE 342

ME ID513 Engineering Acoustics (3 cr) WSU ME 523
See ME J413/ID-J513.

ME 514 HVAC Systems (3 cr)
See ME J414/J514.

ME 515 Transport Phenomena (3 cr)
See ChE 515.

ME 517 Turbomachinery (3 cr)
See ME J417/J517.

ME 518 Discrete System Simulation and Animation (3 cr)
See ME J418/J518.

ME 519 Fluid Transients (3 cr)
See CE 519.

ME 520 Fluid Dynamics (3 cr)
See ME J420/J520.

ME 521 Advanced Computer Aided Design (3 cr)
See ME J421/J521.

ME 526 Statistical Thermodynamics (3 cr)
Probability theory and quantum mechanics, statistical mechanics, thermodynamic probability, molecular interpretation of first and second laws; kinetic theories.
Prereq: Engr 320

ME ID&WS527 Thermodynamics (3 cr) WSU M E 527
Thermodynamic laws for design and optimization of thermodynamic systems, equations of state, properties of ideal and real fluids and fluid mixtures, stability, phase equilibrium, chemical equilibrium, applications of thermodynamic principles.
Prereq: Engr 320 or Permission

ME 529 Combustion and Air Pollution (3 cr)
Formation of pollutants during combustion processes and their subsequent transformations in the atmosphere; emphasis on the effects of design and operating parameters of combustion devices on the nature and composition of exhaust gases, improvements, post-combustion treatment of effluent gases, atmospheric chemistry, transport of pollutants, smog formation, acid rain, ozone formation and destruction.
Prereq: Engr 320 and 335, ME 345 or Permission

ME ID&WS534 Mechanics of Composite Materials (3 cr) WSU M E 534
Analysis of micromechanical and macromechanical behavior of composite materials with emphasis on fiber-reinforced composite; prediction of properties; stiffness and strength theories; laminated beams and plates; dynamic behavior; environmental effects.
Prereq: ME 341 or CE 342

ME 539 Advanced Mechanics of Materials (3 cr)
Same as CE 510 and MSE 539. Limitations of results of elementary mechanics of materials, complex situations of loading and structural geometry, applications to design of machines and structure, introduction to elasticity.
Prereq: ME 341 or CE 342

ME 540 Continuum Mechanics (3 cr)
Stress and deformation of continua using tensor analysis; relationship between stress, strain, and strain rates in fluids and solids; applications.
Prereq: Permission

ME 541 Mechanical Engineering Analysis (3 cr)
Mathematical modeling and solutions to mechanical engineering problems; analytical solutions to linear heat and mass diffusion, waves and vibrations; introduction to approximate techniques.
Prereq: ME 345, Engr 350 or Equivalent

ME 543 Analysis of Thermal Energy Systems (3 cr, max arr)
See ME J443/J543.

ME 544 Conduction Heat Transfer (3 cr)
Formulation of steady-state and transient one- and multi-dimensional heat conduction problems; analytical solution techniques for linear problems including separation of variables, integral transforms, and Laplace transforms.
Prereq: ME 345 or equiv, or Permission

ME ID&WS546 Convective Heat Transfer (3 cr) WSU M E 515
Energy conservation equations; laminar and turbulent forced convective heat transfer; internal and external flow; free convection.
Prereq: ME 345 or Permission

ME 547 Thermal Radiation Processes (3 cr)

Thermal radiation; radiation interchange among surfaces; radiation in absorbing-emitting gases; combined modes of heat transfer.
Prereq: ME 345 or Permission

ME 548 Elasticity (3 cr)
Mathematical analysis of strain and stress, including vectors, tensors, and coordinate transformations; equations of elasticity; stress problems involving extension, torsion, and flexure; theories of failure.
Prereq: ME 341 or CE 342

ME 549 Finite Element Analysis (3 cr)
See CE 546.

ME 551 Experimental Methods in Fluid Dynamics and Heat Transfer (3 cr)
See ME J451/J551.

ME 577 Design for Manufacture and Assembly (3 cr)
Techniques to design for ease of production of components that form a product and the assembly of those components; techniques for design for other life-cycle issues such as design for service and design for the environment.
Coreq: ME 424 or Equivalent

ME 578 Neural Network Design (3 cr)
See ECE 578.

ME 580 Linear System Theory (3 cr)
See ECE 572.

ME ID&WS581 Fuzzy Logic Control Systems (3 cr)
Same as ECE 573. Introduction to fuzzy logic control systems and the methods used to design these systems.
Prereq: ME 481 or ECE 470 or Permission

ME 583 Reliability of Engineering Systems (3 cr)
See CE 541.

ME 585 Design for Six Sigma (3 cr)
An introduction to the theory, process, and application of Design for Six Sigma. Topics include DFSS methodology, QFD, axiomatic design, TRIZ, and failure analysis. (Fall, Alt/yrs)
Prereq: ME 424 and Stat 301, or grad standing and Permission

ME 587 Quality Engineering (3 cr)
Same as EM 587. Designing quality into products and processes through designed experiments; Taguchi techniques and other quality topics of Six Sigma. (Fall, Alt/yrs)
Prereq: Stat 301

ME 599 (s) Non-thesis Master's Research (cr arr)
Research not directly related to a thesis or dissertation.
Prereq: Permission

ME 600 Doctoral Research and Dissertation (cr arr)