DEPARTMENT OF MECHANICAL ENGINEERING

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Mechanical engineering applies the principles of science and technology to create products and systems which benefit mankind in several areas, including: (1) the conversion of energy from natural sources to provide power, light, heating and cooling, and transportation; (2) the design and production of machines to improve and lighten the burden of human work; (3) the creative planning, design, development, and operation of systems for utilizing energy, machines, and other resources; (4) the production of manufactured goods; and (5) the interface between technology and society.

Mechanical engineering is broad in scope and provides a wide range of careers for trained professionals in industry, business, government, and universities. Positions are available in design, testing, manufacturing, research, development, operations, system analysis, marketing, and administration. Mechanical engineers are often involved as professional team members in economic and social-humanistic matters and are responsible for the interaction of technical advances with social and environmental concerns.

Mission Statement

Our mission is to prepare students for entry into professional engineering practice and advanced study through our regionally-recognized program of high-quality instruction, integrated design and laboratory experience, and scholarship.

Program Educational Objectives

1. Learn and integrate. Graduates of the program will be proficient engineering problem solvers capable of identifying, formulating, and solving engineering problems by applying their knowledge of mathematics, science, and engineering.
2. Think and create. Graduates of the program will be effective mechanical engineering designers capable of modeling, designing, and experimentally verifying a thermal system, a mechanical system, a component, or a process to meet specified engineering requirements while considering real-world constraints and the impact their solution may have on society.
3. Communicate. Graduates of the program will be effective verbal and written communicators, and be team members capable of clearly developing and explaining their engineering solutions to diverse groups using appropriate tools and technology.
4. Clarify purpose and perspective. Graduates of the program will display a keen awareness of their professional and ethical responsibility, and practice lifelong learning.
5. Practice citizenship. Graduates of the program will practice environmental stewardship as they consider the impact that their designs have in a global context. Graduates will also add value to organizations, communities and society at large through involvement in professional societies, public presentations, civic engagement and outreach to the next generation.

(Changes subsequent to this may be viewed at www.uidaho.edu/engr/ME/)

Undergraduate Program. Successful completion of the approved curriculum results in the award of the Bachelor of Science in Mechanical Engineering (B.S.M.E.) degree. Our program educational objectives are based on the needs of our constituencies. We focus on the professional and personal development of our students and continuously assess and improve our undergraduate curriculum. Our department is a college and university leader in the use of innovative teaching methods, in vertical curriculum integration, and in the use of applied design projects. Students interact frequently and personally with the faculty and are mentored and advised by them. The strengths of our program are a solid engineering science foundation as demonstrated by the outstanding performance of our graduates on the nationwide Fundamentals of Engineering Exam, a required precursor to becoming a licensed Professional Engineer; a strong design experience featuring the design and construction of several projects; a strong laboratory experience featuring hands-on skills, state-of-the-art instrumentation, broad exposure to instrumentation and principles, and a senior project; multiple teamwork experiences, including the opportunity to lead and to serve in team roles; substantial use of appropriate engineering tools, including the best available software; and multiple communication experiences including written and oral presentations.

The Mechanical Engineering undergraduate program is accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

General questions regarding the undergraduate program should be addressed to the advising coordinator at (208)885-5024, or by email, medept@uidaho.edu. Faculty members are available to discuss details of their specialty areas with interested students.

An academic minor in mechanical engineering is available. Contact the department for more information.

Graduate Program. The following graduate degrees are available in mechanical engineering: Master of Science (thesis), Master of Engineering (non-thesis) and the Ph.D. The department also offers a program in nuclear engineering. Please see the appropriate section in this catalog. Minimum preparation for graduate study in mechanical engineering is a B.S. degree in a mechanical engineering program that is accredited by ABET, Inc. Students entering the program with an engineering or physical science baccalaureate degree in a major other than mechanical engineering must demonstrate proficiency in the subjects required in the B.S.M.E. program. Individual student qualifications are assessed by the departmental graduate committee, which also determines undergraduate deficiencies.

The programs of study are designed to extend the student's understanding of the fundamental engineering sciences and their application to engineering systems design and analysis. Research programs are offered with specialization in many general topics; please see the departmental website for faculty research areas. We maintain and continuously improve a graduate curriculum. Graduate students receive quality mentoring and advising.

Graduate students will develop a plan of study in consultation with their academic advisor that provides for a reasonable concentration in a particular field of interest and a selection of related courses, some of which may be taught outside of the department. For M.S.M.E. and Ph.D. students, the thesis topic will generally be selected from research topics being pursued by members of the departmental faculty. Candidates for the M.E.M.E. degree have the option of an oral exam or presentation of a final project, which is normally given in the final semester of study.

We support education throughout the state of Idaho and beyond by providing quality distance education through the University of Idaho's Engineering Outreach program, and supporting, collaborating and including our faculty at the Boise and Idaho Falls campuses of the University.

Service. We provide engineering services (teaching, consulting, outreach, testing and research) to support industry and national laboratories. In addition, we provide service to professional societies, the college and university, and the region. We encourage our graduates to support the improvement of our program in formal and informal ways. These include student referrals, periodic evaluation, and donations of time, equipment and money.

Courses

See the course description section for courses in Mechanical Engineering (ME).

Mechanical Engineering Undergraduate Curricular Requirements

Mechanical Engineering (B.S.M.E.)

This program is accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012—telephone: (410) 347-7700.

Note: Pre-advising is required to register in any ME course.

To advance to upper-division courses, a student majoring in mechanical engineering must earn certification: the student may accumulate no more than three grades of D or F in the mathematics, science or engineering courses used to satisfy certification requirements. Included in this number are multiple repeats of a single course or single repeats in multiple courses and courses transferred from other institutions.

In addition, students must also earn at least five grades of 'B' or better in these mathematics, science or engineering courses: Chem 111, Engr 210, Engr 220, Engr 240, Math 170, Math 175, Math 275, Math 310, Math 330, ME 123, ME 223, ME 301, MSE 201, Phys 211, and Phys 212. A grade of P (pass) in any of these courses is considered as a C grade in satisfying this certification requirement.

To graduate in this program, a student cannot accumulate no more than five grades of D or F in the mathematics, science, or engineering courses used to satisfy graduation requirements. Included in this number are multiple repeats of a single course or single repeats in multiple courses and courses transferred from other institutions.

Required course work includes the university requirements (see regulation J-3), completion of the Fundamentals of Engineering (FE) examination and:

CE 411	Engineering Fundamentals (1 cr)
Chem 111	Principles of Chemistry I (4 cr)
Comm 101	Fundamentals of Public Speaking (2 cr)
Engl 317	Technical Writing (3 cr)
Engr 210	Engineering Statics (3 cr)
Engr 220	Engineering Dynamics (3 cr)
Engr 240	Introduction to Electrical Circuits (3 cr)
Engr 335	Engineering Fluid Mechanics (3 cr)
Engr 350	Engineering Mechanics of Materials (3 cr)
MSE 201	Elements of Materials Science (3 cr)
Math 170	Analytic Geometry and Calculus I (4 cr)
Math 175	Analytic Geometry and Calculus II (4 cr)
Math 275	Analytic Geometry and Calculus III (3 cr)
Math 310	Ordinary Differential Equations (3 cr)
Math 330	Linear Algebra (3 cr)
ME 123	Introduction to Mechanical Design (3 cr)
ME 223	Mechanical Design Analysis (3 cr)
ME 301	Computer Aided Design Methods (3 cr)
ME 313	Dynamic Modeling of Engineering Systems (3 cr)
ME 322	Mechanical Engineering Thermodynamics (3 cr)
ME 325	Machine Component Design I (3 cr)
ME 330	Experimental Methods for Engineers (3 cr)
ME 341	Intermediate Mechanics of Materials (3 cr)
ME 345	Heat Transfer (3 cr)
ME 424	Mechanical Systems Design I (3 cr)
ME 426	Mechanical Systems Design II (3 cr)
ME 430	Senior Laboratory (3 cr)
ME 435	Thermal Energy Systems Design (3 cr)
Phil 103	Ethics (3 cr)
Phys 211, Phys 211L	Engineering Physics I and Lab (4 cr)
Phys 212, Phys 212L	Engineering Physics II and Lab (4 cr)

One from the following (3-4 cr):

Econ 201	Principles of Macroeconomics (3 cr)
Econ 202	Principles of Microeconomics (3 cr)
Econ 272	Foundations of Economics (4 cr)

Technical Elective requirements for Mechanical Engineering: Fifteen credits of technical electives are required from the list below. The breakdown of credits will be as follows: nine credits must be an ME upper division course, three credits must be an upper division Math, Statistics or Physics course, the remaining three credits may be any course listed in below:

Bus 414	Entrepreneurship (3 cr)
Bus 456	Quality Management (3 cr)
Bus 531	Managing the Design Process (3 cr)
Engr 360	Engineering Economy (2 cr)
Engr 573	Fuzzy Logic Control Systems (3 cr)
Math 371 or Phys 371	Mathematical Physics (3 cr)
Math 420	Complex Variables (3 cr)
Math 428	Numerical Methods (3 cr)
Math 432	Numerical Linear Algebra (3 cr)
Math 437	Mathematical Biology (3 cr)
Math 451	Probability Theory (3 cr)
Math 452	Mathematical Statistics (3 cr)
Math 453	Stochastic Models (3 cr)
Math 471	Introduction to Analysis I (3 cr)
Math 472	Introduction to Analysis II (3 cr)
Math 480	Partial Differential Equations (3 cr)
ME 401	Engineering Team Projects (2-3 cr)
ME 404	Special Topics (cr arr)
ME 410	Principles of Lean Manufacturing (3 cr)
ME 412	Gas Dynamics (3 cr)
ME 413 or ME 513	Engineering Acoustics (3 cr)
ME 414 or ME 514	HVAC Systems (3 cr)
ME 417 or ME 517	Turbomachinery (3 cr)
ME 420 or ME 520	Fluid Dynamics (3 cr)
ME 421	Advanced Computer Aided Design (3 cr)
ME 422	Applied Thermodynamics (3 cr)
ME 425	Machine Component Design II (3 cr)
ME 433	Combustion Engine Systems (3 cr)
ME 443 or ME 543	Analysis of Thermal Energy Systems (3 cr)
ME 444	Air Conditioning Engineering (3 cr)
ME 452 or ME 552	TechVentures: High Technology Entrepreneurship (3 cr)
ME 461	Fatigue and Fracture Mechanics (3 cr)
ME 464 or ME 564	Robotics: Kinematics, Dynamics, and Control (3 cr)
ME 472	Mechanical Vibrations (3 cr)
ME 481	Control Systems (3 cr)
ME 527	Thermodynamics (3 cr)
ME 529	Combustion and Air Pollution (3 cr)
ME 539	Advanced Mechanics of Materials (3 cr)
ME 540	Continuum Mechanics (3 cr)
ME 541	Mechanical Engineering Analysis (3 cr)
ME 542	Optimal Control of Dynamic Systems (3 cr)
ME 544	Conduction Heat Transfer (3 cr)
ME 546	Convective Heat Transfer (3 cr)
ME 547	Thermal Radiation Processes (3 cr)
ME 548	Elasticity (3 cr)
ME 549	Finite Element Analysis (3 cr)
ME 578	Neural Network Design (3 cr)
ME 580	Linear System Theory (3 cr)
ME 583	Reliability of Engineering Systems (3 cr)
Phys 351	Introductory Quantum Mechanics I (3 cr)
Phys 305	Modern Physics (3 cr)
Phys 411	Physical Instrumentation I (3 cr)
Phys 425 or Phys 525	Relativity (3 cr)
Phys 428 or Phys 528	Numerical Methods (3 cr)
Phys 443 or Phys 543	Optics (3 cr)
Phys 444 or Phys 544	Quantum Optics (3 cr)
Phys 464	Materials Physics and Engineering (3 cr)
Phys 465 or Phys 565	Particle and Nuclear Physics (3 cr)
Phys 484 or Phys 584	Astrophysics (3 cr)
Stat 301	Probability and Statistics (3 cr)
Stat 431	Statistical Analysis (3 cr)
Stat 446	Six Sigma Innovation (3 cr)

Any approved 400/500 level course in another engineering discipline

A maximum of 3 credits of the following may be used:

ME 307	Group Mentoring I (1 cr)
ME 308	Group Mentoring II (1 cr)
ME 401	Engineering Team Projects (2-3 cr)
ME 407	Group Mentoring III (1 cr)

Courses to total 128 credits for this degree, not counting Engl 101, Math 143, and other courses that might be required to remove deficiencies.

Mechanical Engineering Academic Minor Requirements

Manufacturing Engineering Minor

This minor is not accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

Bus 370	Introduction to Operations Management (3 cr)
CTE 352	Manufacturing: Metallic Materials and Processes (3 cr)
Econ 202	Principles of Microeconomics (3 cr)
ME 481	Control Systems (3 cr)
ME 410	Principles of Lean Manufacturing (3 cr)

One of the following (3 cr):

Bus 439	Systems and Simulation (3 cr)
Bus 456	Quality Management (3 cr)

Courses to total 20 credits for this minor

Note: Only two ME classes listed above may be used to fulfill requirements for a manufacturing engineering minor AND mechanical engineering technical electives.

Mechanical Engineering Minor

Engr 105	Engineering Graphics (2 cr)
Engr 210	Engineering Statics (3 cr)
Engr 220	Engineering Dynamics (3 cr)
ME 123	Introduction to Mechanical Design (3 cr)
ME 223	Mechanical Design Analysis (3 cr)

Courses selected from the following (including at least 6 cr from ME courses) (9 cr):

Engr 320	Engineering Thermodynamics and Heat Transfer (3 cr)
Engr 335	Engineering Fluid Mechanics (3 cr)
Engr 350	Engineering Mechanics of Materials (3 cr)
ME 313	Dynamic Modeling of Engineering Systems (3 cr)
ME 325	Machine Component Design I (3 cr)
ME 345	Heat Transfer (3 cr)

Courses to total 20 credits for this minor

Mechanical Engineering Graduate Academic Certificates Requirements

Heating, Ventilation and Air Conditioning (HVAC) Graduate Academic Certificate

Note: A grade of 'B' or higher is required in all coursework for this academic certificate.

ME 422	Applied Thermodynamics (3 cr)
ME 444	Air Conditioning Engineering (3 cr)
ME 502	(s) Directed Study (1 cr)

Electives (6 cr):

Arch 463	Environmental Control Systems I (3 cr)
Arch 463L	Environmental Control Systems I Lab (1 cr)
Arch 464	Environmental Control Systems II (3 cr)
Arch 464L	Environmental Control Systems II Lab (1 cr)
ME 414	HVAC Systems (3 cr)
ME 443	Analysis of Thermal Energy Systems
ME 481	Control Systems (3 cr)
ME 514	HVAC Systems (3 cr)
ME 543	Analysis of Thermal Energy Systems

Courses to total 15 credits for this certificate

Mechanical Engineering Graduate Degree Programs

Candidates must fulfill the requirements of the College of Graduate Studies and of the Department of Mechanical Engineering. Applicants for admission generally will have a B.S. degree in mechanical engineering. Those students admitted with degrees in other engineering fields will be expected to complete any undergraduate deficiencies. See the College of Graduate Studies section for the general requirements applicable to each degree.

Master of Science. General M.S. requirements apply, along with departmental requirements as listed in the departmental graduate handbook.

Master of Engineering. General M.Engr. requirements apply, along with departmental requirements as listed in the departmental graduate handbook.

Doctor of Philosophy. General Ph.D. requirements apply, along with departmental requirements as listed in the departmental graduate handbook. Preliminary screening of candidates and program planning for those admitted are essential features of the Ph.D. program. Early in the program, the student must complete a qualifying examination that will be oral and possibly written. The preliminary examination is taken after most of the course work is completed. This examination also includes a presentation of the dissertation progress or proposal. No foreign language is required; however, the department does require a satisfactory level of achievement in mathematics and numerical analyses and in computer programming.

Academic Certificate. In addition to the above degree programs, the department now offers an academic certificate in advanced materials design and in heating, ventilation, and air conditioning (HVAC) systems. A total of 13 credits are required to obtain each certificate. Students are not required to be actively pursuing a graduate degree in order to participate in a certification program. General graduate admission requirements apply, along with departmental requirements as listed in the departmental graduate handbook.

MECHANICAL ENGINEERING COURSES

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, and documentation skills. Three lec and one open 2-hr lab a wk. (Fall only)
Coreq: *Math 170*

ME J201/J401 (s) Engineering Team Projects (1-2 cr, max arr)
Students will be introduced to a systems approach to designing, building and delivering an interdisciplinary engineering project, with an emphasis on learning how to realize a project in an organized team environment. Projects are chosen at the discretion of the department. Additional project duties/assignments required for 400-level credit.
Prereq *for ME 401: ME Certification and Permission*

ME 223 Mechanical Design Analysis (3 cr)
Use of design and problem solving methodology to model requirements, conduct project learning, develop concepts, and realize prototypes. Projects feature elements of electromechanical design, rapid prototyping, and experimentation.
Prereq: *ME 123*
Coreq: *Math 175*

ME 301 Computer Aided Design Methods (3 cr)
Engineering drawing literacy, pre-CAD planning, part modeling, assembly modeling, drawing package formulation, culminating team project involving virtual dissection and reassembly of a complex machine.
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 322 Mechanical Engineering Thermodynamics (3 cr)
Thermodynamic properties of substances, first and second laws of thermodynamics, thermodynamic analysis of mechanical engineering thermal components and cycles, psychrometric process, and introduction to combustion systems.
Prereq: *Chem 111 and Phys 211*

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. Significant use of solid modeling and use of equation solvers.
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: *Engr 240*

ME 341 Intermediate Mechanics of Materials (3 cr)
Mechanics of materials approach to: three-dimensional stress and strain, unsymmetrical bending, shear centers, curved beams, thick-walled pressure vessels, non-circular torsion; energy methods and advanced strength theories. Introduction to elementary kinematics. Significant use of solid modeling and use of equation solvers.
Prereq: *ME 301 and Certification*
Coreq: *MSE 201*

ME 345 Heat Transfer (3 cr)
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 322 and Math 310*
Coreq: *Engr 335*

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)
See ME J201/J401.

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 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 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/J513 Engineering Acoustics (3 cr)
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. ME 513 is a cooperative course available to WSU degree-seeking students.
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 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 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 421 (s) 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. Course concludes with one month-long final project.
Prereq: *ME 301*
Coreq: *ME 341*

ME 422 Applied Thermodynamics (3 cr)
Advanced topics in applied thermodynamics including availability (exergy) analysis of systems, advanced power and refrigeration cycles, combustion, and thermodynamic properties of real fluids.
Prereq: *ME 322*

ME J423/J523 Human Factors and Ergonomics in Product Design (3 cr)
Introduction to and application of Human Factors & Ergonomics Engineering principles in product design. Engineers design systems (e.g., work environments or products) where the human is an integral component. Human Factors & Ergonomics Engineering puts emphasis on how products should be designed so that they are safe, comfortable, and efficient for the human user. This course will focus on how body characteristics, physical and cognitive abilities, and the environment affect how products should be designed to accommodate the intended user(s). Additional projects/assignments are required for graduate credit.
Prereq: *Senior standing in the College of Engineering; or Permission*

ME 424 Mechanical Systems Design I (3 cr)
Study of production realization including project planning, concept design, detail design, and manufacturing processes with multiple realistic constraints. Concepts learned are applied to a two-semester, capstone design project. The project is continued in ME 426. (Fall only)
Prereq: *ME 301, ME 313, ME 325, ME 330, ME 345, and Certification*

ME 425 Machine Component Design II (3 cr)
A continuation of the analytical study of concepts in ME 325 Machine Component Design, by studying how these components are used in applications. In this context, material selection, machinability and strengthening is addressed. Special emphasis is placed on discussions of case studies and detailed design projects involving machine component elements. Significant use of solid modeling and use of equation solvers.
Prereq: *ME 325*

ME 426 Mechanical Systems Design II (3 cr)
Continuation of each two-semester, capstone design project that was started in ME 424. (Spring only)
Prereq: *ME 424*

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*

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 engineering economy. thermal energy system component analysis and selection, component and system simulation, and system optimization. (Fall only)
Prereq: *ME 345*

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 444 Air Conditioning Engineering (3 cr)
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. Cooperative: open to WSU degree-seeking students.
Prereq: *ME 345*

ME J450/J550 Computational Fluid Dynamics (3 cr)
Governing equations of fluid flow; fundamentals of turbulence modeling; accuracy and stability of discretization schemes; verification and validation; boundary and initial conditions; grid generation; CFD post-processing. Application of CFD software (ANSYS FLUENT) through five hands-on CFD Labs including internal viscous pipe flows, external flows over a 2D airfoil and a circular cylinder, and flows in a 2D driven cavity. Additional projects/assignments required for graduate credits.
Prereq: *Engr 335 and Math 330*

ME J452/J552 TechVentures: High Technology Entrepreneurship (3 cr)
TechVentures teaches students how to startup a technology company. Topics are (a) self-management, (b) product design, (c) marketing, (d) finance, and (e) organizational design. This project-based course is open to all majors. One extra project is required for graduate credit.
Prereq: *Junior Standing and Permission*

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 J464/J564 Robotics: Kinematics, Dynamics, and Control (3 cr)
Mathematical analysis applied to spatial robotics including: Rigid body motion using screw theory, forward and inverse kinematics, analyses of forces and velocities using the manipulator Jacobian, serial and parallel chains, robot dynamics and simulation, nonlinear control and adaptive control, and Lyapunov stability theory. Additional projects/assignments required for graduate credit. Recommended Preparation: CS 120.
Prereq: *Math 310, Math 330, and ME 313 or Equivalent*

ME 472 Mechanical Vibrations (3 cr)
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. Cooperative: open to WSU degree-seeking students.
Prereq: *ME 313*

ME 481 Control Systems (3 cr)
Same as ECE 470. Analysis and design of feedback control systems utilizing frequency and time domain methods, and computer-aided design tools. Cooperative: open to WSU degree-seeking students.
Prereq *for Electrical Engineering and Computer Engineering majors: ECE 350*
Prereq *for Mechanical Engineering majors: ME 313*

ME 490 Solid Modeling, Simulation and Manufacturing Capstone (3 cr)
Use of solid modeling software focused on preparation for certification examinations, introduction to multi-physics numerical simulation, and computer aided manufacturing (CAM). A major final project is required. (Fall only)
Prereq: *Permission*

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 513 Engineering Acoustics (3 cr)
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 519 Fluid Transients (3 cr)
See CE 519.

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

ME 521 Design Synthesis with Solid Modeling (3 cr)
Use of solid modeling in the design synthesis process that focuses on optimized designs, reverse engineering to understand design intent, and aesthetics. Course concludes with one month-long final project.
Prereq: *Graduate Standing or ME 421*

ME 523 Human Factors and Ergonomics in Product Design (3 cr)
See ME J423/J523.

ME R525 Advanced Heat Transfer (3 cr)
Application of fundamentals of heat conduction, radiation, and convection; relationships to fluid dynamics and mass transfer; economics and design applications.
Prereq: *Permission*

ME 527 Thermodynamics (3 cr)
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. Cooperative: open to WSU degree-seeking students.
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 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 546 Convective Heat Transfer (3 cr)
Energy conservation equations; laminar and turbulent forced convective heat transfer; internal and external flow; free convection. Cooperative: open to WSU degree-seeking students.
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 550 Computational Fluid Dynamics (3 cr)
See ME J450/J550.

ME 552 TechVentures: High Technology Entrepreneurship (3 cr)
See ME J452/J552.

ME 564 Robotics: Kinematics, Dynamics, and Control (3 cr)
See ME J464/J564.

ME 571 Building Performance Simulation for Integrated Design (3 cr)
See Arch 574.

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

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

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

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)

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