Mechanical Engineering

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Mission

The Mission of the Mechanical Engineering Department is to:

- Prepare students to excel in mechanical engineering and related fields.
- Provide modern, fundamental, practice-oriented education in the mechanical engineering field.
- Foster creativity and critical thinking in problem solving and motivate students to consider the societal consequences of their work.
- Enable students to be leaders in their profession, community, and the nation.

Graduates of the Mechanical Engineering program will:

- Have a strong foundation and ability to apply engineering fundamentals, modern tools, mathematics, science, and humanities to conceive, analyze and implement solutions to problems in the mechanical engineering field.
- Have a broad-based, laboratory-oriented, hands-on engineering education that will enable graduates to practice in a variety of mechanical engineering fields including energy conversion and transfer, materials and manufacturing, and mechanical systems design.
- Be able to work as professionals in industrial, military, government, and academic settings while maintaining a high awareness and responsibility regarding ethical, safety, environmental, social, economic, and global issues.
- Be able to work effectively as a team member and be able to lead a multidisciplinary team.
- Be able to design a component, system or process in the mechanical engineering field and communicate that design effectively through verbal and written means.
- Have a positive outlook on the engineering profession and maintain an ongoing intellectual curiosity while actively engaged in continuing education throughout life.

Mechanical engineering, the broadest of the engineering professions, provides an opportunity for a wide range and variety of services, work, and interests. The mechanical engineer deals with the conversion of energy, the design of machines, the instrumentation and control of processes, and the control of machines and the environment. Conventional fields of interest are transportation (automobiles, aircraft, urban and mass transit); machines and systems for electrical power production from coal, oil, and gas; heating and air conditioning of buildings; and the complex machinery and methods of making steel, plastics, paper products, etc. Today the mechanical engineer is directly involved in new and challenging fields such as computer-aided design and manufacturing (CAD/CAM); artificial body organs and devices (bioengineering); nuclear power generation; applications of electronics to the control of machines and to laboratory instruments; aerospace (spacecraft and rockets); and the control of environmental pollution for automobiles and industry. The diversity of opportunities for the mechanical engineer and the extensive overlap of interests with the other engineering and scientific disciplines demand that the undergraduate education be broad rather than specialized and that it provide a thorough grounding in all of the engineering fundamentals. The curriculum is a carefully structured blend of theory and the practical aspects of engineering. Engineering applications are emphasized in the junior and senior years with three semesters of design. The diversity of the curriculum is also apparent in the senior projects courses where assignments range from the design, construction, and testing of a water quality measuring submarine to the investigation of robotics manufacturing techniques for the compact disc industry. Since three-fourths of the curriculum's technical content consists of a foundation of engineering theory, the graduate is uniquely prepared to attack the technical challenges of the future and solve the new engineering problems of society. The graduate is well prepared for direct employment in the engineering profession or for further formal education in graduate school.

The Mechanical Engineering curriculum is accredited by:

The Engineering Accreditation Commission of ABET
111 Market Place
Suite 1050
Baltimore, MD 21202-401
Telephone (410) 347-7700

B.S. in Mechanical Engineering - Curriculum Map

First Year

Fall	Credits	Spring	Credits
CH 103 General Chemistry I	4	CH 104 General Chemistry II	4
EG 109 Introduction to Engineering i	3	MA 122 Calculus II	4
EN 101 Composition and Literature I	3	EG 110 Introduction to Engineering II	3
MA 121 Calculus I	4	EN 102 Composition and Literature II	3
		General Education Elective[1]	3
	14		**17**

Second Year

Fall	Credits	Spring	Credits
EG 201 Engineering Mechanics (Statics, Dynamics)	3	EE 240 Electrical Concepts and Applications	3
EE 204 Electrical Circuits I	3	EG 206 Thermodynamics I	3
MA 223 Calculus III	4	MA 224 Differential Equations	4
PS 211 University Physics I	4	PS 212 University Physics II	4
ME 211 Mechanical Engineer Tools I	2	EG 202 Engineering Mechanics (Statics,Dynamics)	3
	16		**17**

Third Year

Fall	Credits	Spring	Credits
EG 203 Materials Science	3	ME 356 Manufacturing Processes	4
ME 311 Mechanical Engineering Tools II	2	EG 303 Fluid Mechanics	3
EG 301 Mechanics of Materials	3	ME 368 Design of Machine Elements	3
ME 307 Thermodynamics II	3	ME 370 Mechanical Systems Design	3
ME 363 Kinematic and Kinetic Sythesis	3	ME 382 Mechanical Engineering Laboratory II	1
ME 381 Mechanical Engineering Laborator I	2	General Education Elective[1]	3
	16		**17**

Fourth Year

Fall	Credits	Spring	Credits
EE 321 Embedded Systems	4	EG 043 Professional Issue	0
EG 044 Prep for FE Exam	0	Math/Science/ Engineering Elective	3
ME Elective	3	ME 468 Mechanical Engineering Design II	3
ME 467 Mechanical Engineering Design I	3	General Education Elective[1]	3
ME 487 Mechanical Engineering Laboratory III	2	General Education Elective[1]	3
ME 435 Vibrations and Controls	3		
ME 465 Heat Transfer	3		
General Education Elective[1]	3		
	21		**12**

Total Credits: 130

1 University general education requirement dictates that the Humanities-Social Science Electives be distributed as follows: one history course, one literature course, one course in psychology, sociology, economics or political science, and one arts or humanities course beyond the literature course.

ROTC is required 6 semesters for members of the Corps of Cadets.

All Mechanical Engineering majors are required to take the Fundamentals of Engineering (F.E.) Exam, administered by the State of Vermont or other state, to receive the BSME degree.

Common Engineering Courses

EG 043. Conference. 0 Credits.
A scheduled weekly conference hour with the faculty and senior engineering students for discussions of topics such as placement, professional registration, professional ethics, and professional growth after graduation. The course includes a substantial writing component on ethics. A grade of satisfactory (S) is required for graduation. Classroom 1 hour. Prerequisite: senior standing.

EG 044. Conference. 0 Credits.
A scheduled weekly conference hour with the faculty and senior engineering students for preparation of the Fundamentals of Engineering (FE) exam. The student must take the FE exam to receive a satisfactory grade in this course. EG 044 is not required if the student has already passed the FE exam. Classroom 1 hour. Prerequisite: senior standing.

EG 109. Introduction to Engineering i. 3 Credits.
An introduction to engineering, the concepts of engineering design and the non-technical aspects of engineering. The concepts of graphical communication skills to depict engineering designs using computer aided drawing will be covered. Students will perform design projects to incorporate the technical and the non-technical aspects of design into projects. Classroom 2 hours; laboratory 3 hours.

EG 110. Introduction to Engineering II. 3 Credits.
A continuation of EG 109 to include an introduction to engineering computing through the design of algorithms to solve engineering problems. The design projects will be coordinated with mathematics and science courses being taken concurrently by the students to reinforce the material learned in those courses. Design projects will include the technical and non-technical aspects of engineering design. Prerequisite: EG 109 or permission of the instructor. Classroom 2 hours; laboratory 3 hours.

EG 111. Fundamentals of Engineering I. 3 Credits.
An introduction to engineering and the concepts of engineering design. Includes an introduction to graphical communication skills used in engineering through the use of sketching and computer-aided design (CAD) on personal computers. The concepts of orthographic and isometric drawings are stressed and extended to include sections and dimensions. The use of spreadsheets in engineering is also included. This course is open only to students in an Engineering major or those with permission of the Engineering Division Head. Classroom 2 hours, laboratory 3 hours.

EG 112. Fundamentals of Engineering II. 4 Credits.
A continuation of the concepts of engineering design. Includes an introduction to engineering computing through the design of algorithms using structured techniques that employ a high-level engineering computer language. This course is open only to students in an Engineering major or those with permission of the Engineering Division Head. Classroom 3 hours, laboratory 2 hours.

EG 201. Engineering Mechanics (Statics, Dynamics). 3 Credits.
A course in elementary engineering mechanics. Vector notation. Force systems, moments, equilibrium, the free body diagram. Friction, simple frames, trusses, beams, centroids, and second moments. Kinematics: rectilinear and curvilinear motion; translation and rotation; relative motion. Kinetics: force, mass, and acceleration; impulse and momentum; work and energ y. Elementary vector calculus. Classroom 3 hours. Corequisites: MA 122 and PS 211.

EG 202. Engineering Mechanics (Statics,Dynamics). 3 Credits.
A course in elementary engineering mechanics. Vector notation. Force systems, moments, equilibrium, the free body diagram. Friction, simple frames, trusses, beams, centroids, and second moments. Kinematics: rectilinear and curvilinear motion; translation and rotation; relative motion. Kinetics: force, mass, and acceleration; impulse and momentum; work and energy. Elementary vector calculus. Classroom 3 hours. Prerequisites: EG 201 and MA 122.

EG 203. Materials Science. 3 Credits.
An introduction to the science of materials based on the physics and chemistry of their internal structures. The effects of structure on the properties and behavior of metallic, polymeric, ceramic, semiconductor, and composite materials. Classroom 3 hours. Prerequisite: CH 103.

EG 206. Thermodynamics I. 3 Credits.
A study of the fundamental concepts and laws of thermodynamics and of the p operties of pure substances, with applications to engineering processes and operations. Classroom 3 hours. Corequisite: MA 122.

EG 301. Mechanics of Materials. 3 Credits.
A course on the concepts of stress and strain; effect of loads; analysis of plane stress and strain; deformations of beams, shafts, and axial members; buckling and combined stresses. Classroom 3 hours. Prerequisite: EG 201.

EG 303. Fluid Mechanics. 3 Credits.
A study of fluid properties and their significance. Fundamental mechanics of compressible and incompressible fluid motion with application to engineering problems. Topics include resistance of fluids in laminar and turbulent flow; open-channel flow; fluid statics; dimensional analysis and similitude. Classroom 3 hours. Prerequisite: MA 122; Prerequisite or concurent enrollment: EG 206 or permission of the instructor.

EG 447. Special Projects (Technical Elective). 1-6 Credit.
A report on an approved engineering design project or topic area to meet the specific objectives of a student in a particular area of study. Limited to students who have organized plans and/or projects that can be related to their engineering interests. Hours and credits to be arranged. Prerequisite: permission of the curriculum department chair and advisor.

EG 450. Professional Issues. 3 Credits.
A course to prepare the engineering student for the non-technical aspects of the engineering profession. Topics covered include engineering registration, ethical responsibilities, malpractice and legal responsibilities, and the business aspects of the engineering profession. Classroom 2 hours. Recitation 2 hours. Prerequisites: junior or senior status.

Electrical Engineering Courses

EE 200. Engineering Programming. 3 Credits.
Introduction to a high level programming language such as C/C++. Topics include structure and organization of a computer program, variables and basic data types, flow of control, functions, file I/O, arrays and strings, computer memory, CPU and pointers, user defined structures, computer algortithms, modular design and documentation. Introduction to object oriented programming concepts. This course is offered once a year.

EE 204. Electrical Circuits I. 3 Credits.
A study of principles and methods of analysis of electric circuits with both direct and time varying sources in the steady state. KCL, KVL, mesh and nodal techniques. Network theorems are developed and applied to the analysis of networks. Energy storage elements. First order and second order circuits with forced and natural responses. Sinusoidal analysis, complex numbers, phasor diagrams. Power; average effective, and complex power in single phase systems. Classroom: 3 hours. Corequisite: MA 122.

EE 215. Fundamentals of Digital Design. 4 Credits.
An introductory course on formal design techniques for combinational and sequential logic circuits. Topics include combinational logic networks, minimization techniques, registers, synchronous sequential neworks, and control units. Applications of the concept developed in the classroom will be implemented in the laboratory. Classroom 3 hours, laboratory 2 hours.

EE 240. Electrical Concepts and Applications. 3 Credits.
A course on the theory and application of electrical devices and circuits. Discussions include magnetic circuits, transformers, electric machines, diodes, bipolar transistors, and field effect transistors. Integrated circuits are introduced. Digital switching circuits are treated, including logic gates, flip-flops, and counters. Operational amplifiers and their major applications are studied. Offered to qualified students not majoring in Electrical Engineering. Classroom 2 hours, laboratory 3 hours. Prerequisite: EE 204.

EE 242. Digital Systems Design. 4 Credits.
Topics are hierarchical design methods, design and debugging of digital hardware, determination of circuit behavior, control and timing, machine organization, control unit implementation, and interface design. A hardware design language will be used and students will acquire design experience implementing digital hard ware. Classroom 3 hours, laboratory 2 hours. Prerequisite: EE 215.

EE 303. Electromagnetic Field Theory I. 3 Credits.
Maxwell's Equations are developed from the experimental laws of electric and magnetic fields. Topics involving electric fields include Gauss's Law, divergence, energy, potential, conductors, dielectrics, and capacitance. Topics involving magnetic fields include the Biot-Savart Law, Ampere's Law, magnetic forces, magnetic materials, and inductance. Maxwell's Equations are used to describe wave motion in free space and in dielectric media. Classroom 3 hours. Prerequisites: MA 223, EE 204.

EE 314. Elements of Electrical Engineering. 4 Credits.
A course on the theory and application of electrical devices and circuits. Topics that are appropriate for discussion include dc circuits, single-phase and three-phase ac circuits, amplifiers, transducers, transformers, and electric machines. Offered to qualified students not majoring in Electrical Engineering. Classroom 3 hours, laboratory 3 hours. Prerequisite: MA 122.

EE 321. Embedded Systems. 4 Credits.
The use of computing devices in embedded applications is introduced. Computer organization topics include the arithmetic logic unit, timing and control, memory, serial and parallel I/O ports, and the bus system. Programs are written and run in assembly language and higher-level languages. Additional topics include peripheral interface control, interrupts, cross assembly and applications. Classroom 3 hours, laboratory 2 hours. Prerequisite: EG 110 or IS 130.

EE 325. Computer Architecture and Operating Systems. 3 Credits.
Machine architecture - machine performance relationships, computer classification, and computer description languages. Consideration of alternative machine architectures. Software influences on computer design. Topics include digital logic, VLSI components, instruction sets, addressing schemes, memory hierarchy ache and virtual memories, integer and floating point arithmetic, control structures, , buses, RISC vs. CISC, multiprocessor and vector processing (pipelining) organizations. Examples are drawn from Pentium and Sparc microcomputers. The primary focus is on the attributes of a system visible to an assembly level programmer. This course also introduces the fundamentals of operating systems. Topics include concurrency, scheduing, memory and device management, file system structure, security, and system performance evaluation. Lecture 3 hours. Offered once per year.

EE 350. Linear Systems. 3 Credits.
This course provides the foundations of signal and system analysis. Linear, time-invariant, causal, and BIBO stable analog and digital systems are discussed. System input-output descriptions, convolution and the impulse response are covered. Additional topics include singularity functions, Fourier and Laplace circuit analysis, circuit transfer functions, Bode plots, ideal filters, and real filters including Butterworth, Chebyschev, and Elliptic. Discrete topics include the transform, difference equations, FIR and IIR filters, the bilinear transformation, the DTFT, the DFT, and the FFT. Classroom 3 hours. Prerequisite EE 356.

EE 356. Electrical Circuits II. 3 Credits.
This course is a continuation of Electric Circuits I (EE 204). The complete solutions of linear circuits by Laplace transforms are developed. The concepts of frequency response, resonance, network functions, two port networks including hybrid parameters are studied in depth. The concepts of transformers, power, coupled circuits, multi-phase circuits, and Fourier series are introduced. Computer-based circuit simulation is used throughout. Classroom 3 hours. Prerequisite: EE 204.

EE 357. Electronics I. 3 Credits.
The basic building blocks used in electronic engineering are studied. Diodes, bipolar transistors, and MOS transistors are modeled and then used to describe the operation of logic gates and amplifiers. Emphasis is placed on the operation and applications of standard integrated circuit chips. Classroom 3 hours. Prerequisite: EE 204.

EE 359. Electrical Engineering Laboratory. 1 Credit.
Implementation, analysis, and design of electric and electronic circuits involving resistors, inductors, capacitors, diodes, bipolar transistors, MOS transistors, operational amplifiers and filters. Study and practice in the use of standard electrical engineering laboratory instrumentation. Laboratory 2 hours. Prerequisite: EE 215; corequisites: EE 356, EE 357.

EE 366. Electronics II. 4 Credits.
This course is a continuation of Electronics I (EE 357). Analog and digital circuits are discussed. Analog topics include frequency response, real world applications of operational amplifiers, power amplifiers, filters, oscillators and A/D and D/A converters. Digital electronic building blocks are discussed, including flip-flops, counters, coding and decoding circuits and memory. Classroom 3 hours, laboratory 2 hours. Prerequisites: EE 357, EE 359.

EE 373. Electrical Energy Conversion. 4 Credits.
A course on principles of energy conversion in electromechanical devices and machines. Analysis of transformers, polyphase synchronous and asynchronous machines, single phase fractional horsepower machines, and DC machines. Classroom 3 hours, laboratory 2 hours. Prerequisite: EE 356; corequisite: MA 224.

EE 399. EE Topics. 3 Credits.

EE 3XX. Electical Engineering. 4 Credits.

EE 411. Microprocessor-Based Systems. 4 Credits.
This course deals with organization, operation and design of systems where the microprocessor controls special interfaces to non-standard devices and responds to external events in a timely fashion. Topics include interface of special purpose peripherals, data structures, control structures, program and data organization and real time operating systems. Application to communications, automated measurement, process and servo control are discussed. Classroom 3 hours, laboratory 2 hours. Prerequisites: EE 215, CP 321.

EE 459. Power Systems Analysis. 3 Credits.
This course presents the foundations of electric power systems analysis after an initial review of single and three-phase power, complex power and transformers. Topics include per unit quantities, generators, transmission line models, transformer models, short-circuit analysis, load flow, and power systems economics. Lecture: 3 hours. Prerequisites: EE 356 and EE 373. Offered once per year.

EE 463. Communication Systems. 4 Credits.
Analog transmission of information signals by communication systems is analyzed. The component parts of transmitters and receivers including AM/FM modulators, filters, detectors and decoders are discussed. Mathematical concepts include the Fourier Series, Fourier Transform, dirac delta function and sinc function. Signal classification and digital modulation techniques such as ASK, FSK, PSK, PAM and QAM. Classroom 3 hours, laboratory 2 hours. Prerequisites: EE 356, EE 357, EE 359.

EE 468. Solid State Materials. 3 Credits.
Solid state materials, physics of electronic devices and integrated circuit design are studied. Topics include silicon crystal properties, diffusion, implantation, lithography and circuit fabrication. Device models are derived for junction diodes, bipolar and MOS transistors. Classroom 3 hours. Prerequisites: EE 303, EE 357.

EE 478. Control Systems. 3 Credits.
Analysis and design of continuous-time and discrete-time control systems using classical and state-space methods. Laplace transforms, transfer functions and block diagrams. Transient-response analysis, Routh-Hurwitz stability criterion, and steady-state error analysis. Analysis of control systems using the root-locus and frequency-response methods. Computer-aided design and analysis. Lecture: 3 hours. Prerequisites: EE 204 and MA 224. Offered once per year.

EE 486. Digital Signal Processing. 3 Credits.
An introductory level course that discusses the conversion of analog signals to discrete time signals. Emphasis will be on the processing of discrete signals using both time-domain and frequency-domain analysis. These techniques will be applied to the design of digital filters. Classroom 3 hours. Prerequisite: EE 350 or instructor's permission.

EE 487. Digital Signal Processing Lab. 1 Credit.
Implementation analysis and design of digital signal processing functions and techniques. Study and practice in the use of software and hardware platforms used for digital signal processing applications. Laboratory: 3 hours. Prerequisite: EE 350. Co-requisite: EE 486. This course is offered once a year.

EE 490. Advanced Topics. 3 Credits.
A course that provides advanced study in an area of the instructor's special competence. Courses that have been offered in the past include Power System Stability, Electrical Communications II, Microwave Theory and Techniques and Digital Systems. Offered as the occasion demands. Classroom 3 hours. Prerequisite: senior standing.

EE 491. Electrical System Design I. 3 Credits.
Introduction to design problems. Application of concepts of electrical engineering to a capstone design project. The first of a two-semester sequence, this course focuses on the problem statement, specification, preliminary design, design review and approval stages of the design processes, the design process involves exploring alternate solutions and design optimization and simulation. Economic constraints and human factors are considered in the design process. The course requires nine hours per week of directed reading, research and experimentation. Prerequisite: seventh semester standing and permission of the instructor.

EE 494. Electrical System Design II. 3 Credits.
This course is the second in the two-semester capstone design project sequence. It focuses on the final stages of the design process-finalized design, implementation and testing. A written project report and an oral presentation to students and faculty is required. Nine hours per week of directed readings, research, and experimentation. Prerequisite: EE 491.

Mechanical Engineering Courses

ME 211. Mechanical Engineer Tools I. 2 Credits.
An extension of EG 109 with a more in-depth treatment of 3-D solid model generation including extrusion, revolving, sweeping and lofting. Further development and modification of 3-D solid drawings. Laboratory: 3 hours. Prerequisite: EG 109.

ME 307. Thermodynamics II. 3 Credits.
Applications of thermodynamics to power and refrigeration cycles, combustion mechanisms, mixture and flow processes. Development of thermodynamic relationships and equations of state. Classroom 3 hours. Prerequisite: EG 206.

ME 311. Mechanical Engineering Tools II. 2 Credits.
An extension of ME 211 with additional application of computer based design and analysis methods. An emphasis will be placed on design for manufacturing and other tools appropriate to the mechanical engineering profession. Laboratory: 3 hours. Prerequisite: ME 211.

ME 356. Manufacturing Processes. 4 Credits.
A study of the principles of manufacturing processes. Metal removal, casting, joining and deformation processes are covered as well as introductions to numerically controlled machinery, computer-aided manufacturing, rapid prototyping, robotics, computer integrated manufacturing and modern manufacturing systems. Classroom 3 hours, laboratory 3 hours. Prerequisite: ME 311, EG 203.

ME 358. Metallurgy & Manufacturing. 4 Credits.
A study of the principles of physical metallurgy and manufacturing processes. The structure of metals, strengthening mechanisms, metal removal, deformation processes and welding are covered as well as introductions to numerically controlled machinery, computer-aided manufacturing, and robotics. Classroom 3 hours, laboratory 3 hours. Prerequisite: EG 203.

ME 363. Kinematic and Kinetic Sythesis. 3 Credits.
A study of the principles of motion and the forces necessary to cause, and be created by motion. Applications to the design of typical machine elements such as gears, linkages and cams. Classroom 3 hours. Prerequisites: EG 202, MA 223.

ME 368. Design of Machine Elements. 3 Credits.
A study of the application of the theories of mechanics and stress analysis to the design of fundamental machine parts. Some of the topics covered are shafts, springs, screws, belts, gears, rivets, bearings and lubrication. Classroom 3 hours. Prerequisites: EG 301.

ME 370. Mechanical Systems Design. 3 Credits.
An introduction to the methodology of design including problem definition, generation and evaluation of alternatives, and design completion. Emphasis is placed on creativity, feasibility, and the effect of economic and societal factors on alternative selection. Goals are achieved through the use of case studies and small projects. Classroom 3 hours. Prerequisite: junior standing.

ME 381. Mechanical Engineering Laborator I. 2 Credits.
A study of the fundamentals of mechanical and electronic instruments and their use in measurement systems to obtain data on temperature, pressure, displacement, acceleration, and other physical variables. Introduction to experimental methods and procedures, reduction of data to significant form, and the organization of experimental results in written reports. Lecture 1 hour, laboratory 3 hours. Prerequisite: EE 204.

ME 382. Mechanical Engineering Laboratory II. 1 Credit.
Application of instrumentation to observations of gas and liquid behavior, thermo-dynamic and mechanical aspects of machines and devices. Dynamic and transient considerations in instruments, physical systems, and experimental data. Laboratory 3 hours. Prerequisite: ME 381.

ME 435. Vibrations and Controls. 3 Credits.
Synthesis and analysis of mechanical control systems with feedback. Use of linearization techniques and Laplace Transform methods of analysis. Techniques for determining system stability. Emphasis is placed on operational characteristics of components and their effect on system design. Computer simulation of system operation. Classroom 3 hours. Prerequisites: MA 224, EG 202.

ME 465. Heat Transfer. 3 Credits.
A study of the fundamentals of heat transfer by conduction, radiation, and convection. Steady and unsteady state conduction. Study will include boundary layer theory, internal and external convective flows, two-phase flow, and heat exchange design theory. Classroom 3 hours. Prerequisites: EG 206, EG 303, MA 224.

ME 466. Gas Dynamics. 3 Credits.
A course that continues EG 303 as applied to compressible fluids. One and two dimensional flow and oblique shocks. Classroom 3 hours. Prerequisites: EG 303, EG 206. Offered as occasion demands.

ME 467. Mechanical Engineering Design I. 3 Credits.
A capstone design project is taken up to the point of prototype construction, testing and hardware specification. The specific skills and knowledge needed by practicing engineers in the product realization process are emphasized and developed. Classroom 3 hours. Prerequisite: senior standing, ME 370.

ME 468. Mechanical Engineering Design II. 3 Credits.
Design completion of the capstone project initiated in ME 467 including hardware specification, instrumentation, laboratory testing, data reduction, and evaluation. Written design report required with oral presentation and defense. Prerequisite: ME 467.

ME 474. Internal Combustion Engines. 3 Credits.
A course that correlates previous work in thermodynamics, heat transfer and design in the study of internal combustion engines. Classroom 3 hours. Prerequisites: ME 465, ME 307. Offered as occasion demands.

ME 487. Mechanical Engineering Laboratory III. 2 Credits.
A continuation of the Mechanical Engineering laboratory sequence with experiments stressing the performance characteristics of heat power equipment and the application of theory learned in thermodynamics and fluid flow. Classroom 1 hour, laboratory 2 hours. Prerequisite: EG 303. Corequisite: ME 307.

ME 490. Advanced Topics. 3,4 Credits.
A course that provides specific work in an area of the instructor's special competence and indicated student interest. An extension of basic principles to applied areas such as HVAC, heat transfer, thermodynamics, stress analysis, environmental control, turbo-machinery, propulsion systems and aerodynamics. Classroom or seminar, 1-3 hours. Prerequisite: senior standing. Offered as occasion demands.